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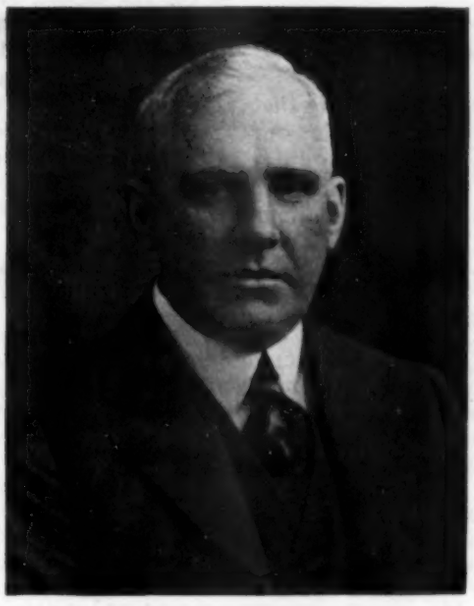

"If your equipment is obsolete, sell it. If you can't sell it, scrap it. It is too expensive to have around the shop."

Getting the Most Out of Your Machine Tool Dollar

By J. A. Smith

General Superintendent, General Electric Co.
Schenectady

WHY does the big manufacturing corporation produce machinery at a lower cost than its smaller competitors? The prices of raw materials are practically the same to all. Occasionally the big fellow may be able to purchase a little more advantageously when he wants a huge quantity but, generally speaking, there is little to choose. Labor rates are practically stabilized in any locality and the corporation pays the going rate.

As I see it, the only chance for the corporation is to employ better methods or use better equipment. With a large number of departments involved, tools can be shifted from one place to another as they depreciate in value, and the last cent's worth of usefulness can be squeezed out of them. At any rate this has been my philosophy during my fifteen years with the General Electric Co., and I think the results have justified it.

How do we know when a machine tool is not earning its keep? By a careful system of records that show every dollar spent on it for any purpose since it was put into service. Expenditures are caused by:

(1) Carelessness or ignorance on the part of the operator. If it is ignorance we expect our foremen or efficiency men to acquaint our operator more fully with the machine, that a repetition of the same mistake by the same operator may not be expected.

(2) The wrong kind of material employed in the machine. This may cover material originally furnished with the machine or applied by us in course of repairs.

(3) Lack of proper lubrication, whether due to poor design or lack of operator's attention.

(4) Improper tooling or use of inferior cutting tools.

(5) Wrong application to work in hand, overload, etc.

Every machine is numbered and cross-indexed and we can check up on it at any time. Once every five years we go over the whole record and make a study of the tools taken out of service, to see why they were taken out and how much was spent on each of them. We find out how long they were in service, whether or not they were on night and day work, the type of operator assigned to them, whether they were doing fine or rough work. We are then in a position to arrive at a sound rate of depreciation for other tools of the same type and we can report to the stockholders just how much of each dollar invested in equipment is represented by actual value-producing machine tools.

To be sure that the wear-out point shall be postponed as long as possible there is one man in each department, or perhaps two or three in the larger ones, each to act as a machine tool inspector constantly watching the machines in his department to see that they are functioning properly, that they are being oiled at the right time, that any small breaks are immediately repaired, that they are withdrawn from use for overhaul when necessary. His work is an application of the old proverb, "A stitch in time . . .," and it certainly works out, for it is not necessary to scrap the machines nearly so soon as would otherwise be the case.

Perhaps you might call these men "constructive fault-finders." There is another group of efficiency men reporting directly to me, who might be termed "destructive fault-finders." They have a roving commission and an important part of their job is to spot the machines that are not producing 100 per cent and to recommend

that they be transferred, sold or sent to the scrap pile.

We have not the slightest sentiment about worn-out or obsolete machines. No matter what their historical background may be, out they go for either one or both of the following reasons:

(a) Our record shows that repairs are altogether too frequent, too costly and result in repeated non-productive idleness, or

(b) By a simple case of arithmetic we can prove that the purchase of another machine of either the same or a totally different type, is a good investment.

I believe it is thoroughly bad for shop morale to keep a lot of superannuated machine tools standing around. They occupy valuable space that ought to be devoted to a productive machine. They tie up motors that ought to be working.

If a machine is not likely to be used again very soon in its present location, we move it to some other department where it can be used, sell it if it has more than scrap value, or scrap it if it has not.

Efficiency men and inspectors report from two to a dozen machines to me every day and, if there is no question about the recommendation, I sign the death warrant at once. If there is any question, we go out and examine the machine together and then dispose of it. No company equipped with obsolete tools can hope to compete these days and the only cure for the ailment is amputation and replacement.

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What makes a machine tool obsolete? Two things: The development of the art through which the modern tool produces more than the one it supplants, and the nature of the tool and the way it has been treated.

Many a tool has been rendered obsolete here although its useful life had hardly begun. A newer and better tool came along and we simply could not afford to do without it. The older tool we sell to somebody who can afford to use it, whose competitive conditions are not as severe as ours.

Now, as to the type of the tool and the use to which it has been put, perhaps an example or two will explain what I mean. From the nature of our work we use many boring mills. Some of them are twenty-five years old and are still good. Of course they are not up to the modern mills in performance but we can find plenty of the less exacting jobs to use them for and thus save our new mills for the hard work.

Suppose we have a machine of the Brown & Sharpe automatic gear cutter type. If it has been used carefully in a toolroom it may be perfectly good after twenty years of service. If, on the other hand, it has been on production work, driven hard by a none-too-considerate operator, its usefulness as an accurate tool may be ended in five years. All these things must be considered when depreciation rates are set and the obsolescence of a machine is determined.

In making replacements there is a psychological factor to be dealt with. In my experience I have found that it does not pay to introduce one new machine into a battery of old ones. In a piece work department the rates are usually set so that the man with the poorest machine can get by. The result is that the other operators have a tendency to adjust their speed to his, to a certain extent, and the new machine is not pushed to anywhere near its capacity.

The solution of the trouble seems to be to keep all of the machines in a battery at about the same standard of efficiency, replacing the whole group when it becomes necessary and disposing of the rejects to some other department where they can be used to advantage, or getting rid of them entirely.

When a battery of new machines is installed we naturally set new piece rates to allow for the increased output capacity of the equipment. We make careful studies and set the rate as near right as we know how. If one man, or several men, is able to beat the time set consistently, we look upon the achievement as a possible error on the part of the rate-setter, but a good one, in that the man is making more money and the company is getting greater production from the new machine than it otherwise would. The rate is not disturbed until some very definite change is made in machine, tooling or method.

Shop conditions differ a little in the Schenectady Works of the General Electric Co., from those existing in any other plant that I know of. The principal reason is that our plant does development work for the whole company. When a new product has become established in its market and the equipment has been brought to the stage where quantity production can begin, the whole outfit is moved to some other plant. Most of the machine equipment usually goes along.

Conditions in the other plants are likely to be different from those at Schenectady, particularly in regard to the power supply. Alternating current is available at one plant, direct current at another, both at a third. As a consequence, we have found it advisable, as a general practice, to order machines equipped with single-pulley drive. They are sufficiently flexible for our purpose because they can be set up in any combination, with any kind of driving motor, in any plant to which they may be sent.

Another point in favor of the single-pulley machine is that it is more readily saleable to dealers, a factor to be considered when you dispose of as many tools as we do.

In selecting machine tools I consider those that have sufficient range through gearing to permit drive from a constant-speed motor. Because of the rapidly changing conditions I have also found it advisable to use more or less standard tools with a range somewhat greater than that called for by the job in hand. I think it will be obvious that single-purpose machines would be in constant danger of becoming obsolete for our purposes long before they were worn out.

One other factor that enters into our purchasing policy may be worth setting down. We do not buy for-

eign-built tools unless it is impossible to get an equally good one from home manufacturers.

As stated, we are constantly moving machines around. A new industry like the radio parts business may spring up and grow so fast that other machines have to be moved out to give it room to grow. When this happens we usually find quite a few machines that can be sold or scrapped. Sometimes a few of them will be better than some that are working in another department. In that case we move them to that department and dispose of the poorer ones they replace.

When times are dull we have to let down somewhat in our replacement activities. It isn't always good policy to order a new suit of clothes when you are sick in order to have it to wear when you get well again. You may put on so much weight when you get up that the suit wouldn't fit. By the same token we can't always tell just where we are going to be busiest when business picks up; and we may have bought a lot of equipment we can't use if some line we had expected to pick up lies dormant while a totally different one starts to boom. We make good use, however, of the time at our disposal during quiet periods in business. We overhaul and put in first class shape the equipment which we intend to keep. We gain two advantages:

(1) We keep our better grade of help employed and (2) we are prepared for the business which always lies ahead and is certain to be with us.

General Faults of Machine Tools

As might be expected, our study of machine tools has given us some definite ideas about them. Two of them stand out from the rest:

(1) Generally speaking, machine tools cover too wide a range in their speed and feed variations. This is a good fault for the small shop, where perhaps only one machine of each type is used. From the standpoint of a large manufacturer, however, the great selectivity of speeds and feeds is not always needed. For a production job which may tie up a machine for a considerable length of time, it is often more desirable to have simplified geared headstocks, etc. The usually complicated nest of gears is reduced to a minimum of moving parts, and sources of trouble are correspondingly decreased.

(2) The second point is the neglect in providing an oiling system which actually supplies oil to the points where it does some good. A great majority of "causes for repair" are shown to be due to inadequate lubrication. In the past I have repeatedly called this fault to the attention of manufacturers and designers, and while some have made decided improvements in this respect in the last few years, still a great number of the builders fail to give this point the consideration it rightfully deserves.

Our records show us very clearly when the difficulties with a tool are caused by faulty design or poor workmanship on the part of the builder. In such a case we look up another builder when we want another machine of the same type.

Free service has little influence with us when a tool is a trouble-maker. Such a machine is apt to become obsolete very quickly. No matter how willing the maker is to replace faulty parts, we cannot afford to have any machine tying up production, occupying valuable floor space and demanding the attention of expensive inspectors and trouble men.

Even the best of the machine tool builders occasionally pick a "lemon" and I think the reason may be something like this: When a new machine is built and put to work in the shop of the builder it is operated by men who know all about it. If a setscrew breaks off, they go to the stockroom and get another one and the tool is down only a short time. They are well enough acquainted with the machine to know where it is likely to fail and they waste no time hunting for the trouble.

If the same accident happens to us we are up against it. We don't know where the weak points are and so a trouble man has to go over the whole machine until he finds what is wrong. The chances are we have no spare part and have to send to the maker for a new one, and the result may be a week or ten days of idleness for the machine. What seemed insignificant to the builder and his men is a serious matter to us and may result in no future orders for that particular machine.

Although great progress has been made in recent years in constructing machine tools more nearly foolproof, there is still a great deal to be accomplished in avoiding an evil that costs the user real money.

Correlation of Structural Conditions With Results of Notched Bar Tests of Metals

Single-blow and slow-bending notched bar tests of several metals and alloys rolled into flat plates and tested by the Bureau of Standards in its investigation of methods of notched bar testing, showed marked differences in results on specimens with the notch cut on the top or on the side of the plate, according to Technical News Bulletin No. 93. To explain the results, an extended metallographic study has been made of the specimens.

It is well known that the location of an impact test bar in relation to the direction of rolling, i.e., whether it is a longitudinal or a transverse bar, greatly affects the results, and that if both longitudinal and transverse bars are taken, the results throw much added light on the quality of the material. This series of specimens, all cut longitudinally, shows that the location of the notch on the top or side of a longitudinal specimen from a flat plate also throws much light on the directional properties of the material. The differences brought to light by the impact tests are shown to be directly connected with the number and type of inhomogeneities present, whether they be non-metallic inclusions or essential metallographic constituents. From one point of view, the work shows that the type of alloy used, or the presence of inclusions or dirt may greatly affect the reliability of the material for engineering uses when the material is stressed in different directions. From another it shows that impact tests on suitable specimens can be used to give information to the engineer on these directional properties, and that for the proper interpretation of the results of impact tests the location of the notch in respect to directional inhomogeneities must be definitely known.

Many engineers question the real usefulness of impact testing because of alleged erratic results and the obscurity of the relation between test values and service. This work should be of value in showing a cause for results which appear erratic if superficially considered, but which, when correlated with the metallographic constitution of the material, are not only not erratic, but throw valuable light on the usefulness of the material.

Have You Ever Thought This Way?

By W. Edward

THERE are three stages in every man's business experience. First, he must secure employment in an industry. That puts him in the first stage, "On probation Subject to Acceptance." He will reach the second stage, that of "Acceptance as an Average Employee," if he pulls with the others with whom he works in a satisfactory manner.

He has arrived at the final stage and is "Respected on the Job," providing he then so bends his efforts that he shows he is beyond the average, that he can and does think constructively for his employers and for himself, in short that he is not in the "me-too" class of every-day plodders.

Which all lines up very nicely and sounds rather simple, and is simple to those who have reached that third stage and can look back over the way they came. But to the others, the many who have gotten as far as the second stage and have been unable to get beyond that point and to those among them who have started anew and reached the point again only to find themselves against a wall, it is no easy or simple matter at all. Here perhaps are a few reasons put as questions that a man may ask himself if still he is not satisfied to be just another "me too."

When you start on each new job, is it not true that from the very fact you are new and unprejudiced by tradition, that you can see many things which could be improved on?

Do you not usually scan these facts hastily and then propose them as soon as you can get the ear of your superior? And does he not generally turn them down?

Is there not a very good reason for this action in that you are new on the job and looked on as being unacquainted with many important factors in the business, facts that have probably so far defeated your superior himself?

In short, is not the fact of your being in the first stage "On Trial" really more than enough argument for him to reject your suggestion, and are you not defeated almost before you start?

The Right and Wrong Time for Suggestions

Suppose as you look back on past experience you recall some of the plans you suggested before. Were not many of them taken up and acted on when suggested again in another form by one of the older men in point of service? One perhaps who had heard your plan and seen its value, but thought it out carefully before putting it across.

Would not this indicate rather clearly that while you are in the first stage, you should be the listener and bend all your efforts to get into the second stage, that of being "Accepted on the Job"?

And while you work and listen and learn by doing both, continually keeping at the development of your plans, polishing off rough edges here, sharpening a valid argument there, do you not approach a point of being so fortified with valuable information that when you do reach the coveted second stage you will be able to prove by constructive suggestions that you are already on your way to the third?

Then, upon being accepted on the job, your plans can be put down in writing, and having withstood the test of increasing experience, can be presented without the handicap of being regarded by your superior as coming from one who is but on trial.

Many a man suggests before he gives himself time to build a valid defense or to construct an objection-proof plan. Almost invariably failures result for that reason.

Depending on the comeback qualities of the man who proceeds in this hasty fashion, it will take a longer or shorter time for him to reach the "me-too" class. Only by a streak of luck will he ever get beyond it.

Cutting Prices on Bankers' Orders

By John R. Godfrey

"Say, Godfrey, I'm darn glad no banker loaned me enough money so that he runs the business for me." 'Twas old man Johnson speaking. "Bankers are all right, as bankers, but some of 'em get my goat when they try to run a machine business.

"They sell me money, or rather credit, when I need it, at the market rate, and they'd have a fit if I asked them for a special price. But when they get into the machine game they go back to the tactics of the Bowery clothing dealer in the Horatio Alger days, when Tattered Tom and Ned the Newsboy were national characters.

"Now here's my friend Bill Williams who builds machinery for automobile plants and such. Bill overexpanded during the war and the banks loaned him so much money he has to tip his hat when he passes a cashier's window.

"Bill makes a good machine and has always been a stickler for maintaining prices. Said if his price list didn't mean what it said, how was a customer to know that everything else he said about the machine could not be discounted, too?

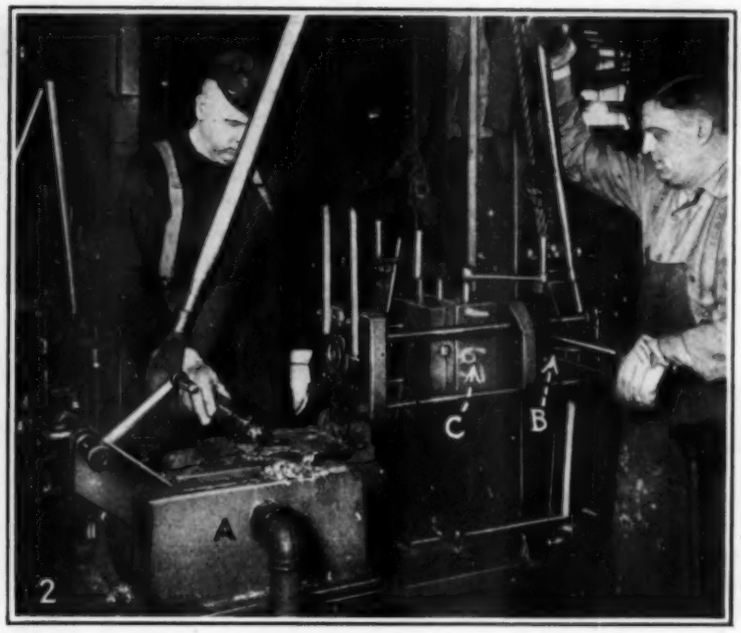
"Been getting a few good sized inquiries lately and one in particular that he wanted to get. But the purchaser knowing he needed the work demanded a discount. Now Bill, as I said, was dead set against what he boldly calls 'lying price lists,' and he was game enough to stand pat. Knew pretty well he'd get the order anyhow in the end.

"But the banker got nervous when he heard about it. Said there were some interest charges coming due and the bank had to have money to protect the widows and orphans (some of them with Rolls-Royce limousines), who looked to it for security, and made Bill take the order at a discount.

"That, of course, is only the beginning. In spite of deep, dark secrecy, a lot of Bill's other customers got wise and will demand the same price when they buy. All of which don't make it a bit easier for Bill to pay off his creditors or to sleep nights. Uneasy lies the head that cuts prices, you know, Godfrey. The banker's longing for cash in the till is likely to make it harder for him to get the rest of it at all. And poor Bill's likely to find himself warming his feet in a snowbank, watching the sheriff nail up the door.

"As I said before, Godfrey, I'm darn glad I don't owe any banker enough to let him tell me when to take an order. It's often cheaper to lose an order and better for the industry if you do."

Looks like the old man hasn't lost all his pep, even if he does take time for fishing and leave the shop to Tom once in a while.



Figs. 1 and 2—The three main units of equipment used in the die-casting process: A, casting machine; B, vise; C, die

The Principles of Die Casting

By H. C. Skinner
General Manager, Franklin Die-Casting Corporation

Die-castings defined — Plunger and air types of casting machines — Permanent mold equipment—The scope of die-castings

THE term die-casting, used in its broadest sense, may cover all parts cast in steel or iron molds as opposed to those made in the more common sand molds. Properly classified, however, these castings may again be divided: Die-casting in its proper sense is the term given to castings produced by the process of forcing molten metal through a casting machine into steel dies by the use of pressure other than gravity, while the term permanent mold castings is commonly given to parts produced by pouring the metal into steel or iron molds, the latter process relying to a large extent on the proper spruing and on risers for the results secured.

While it is generally admitted that castings were commonly produced in permanent and semi-permanent molds of various types before the sand mold came into use, the present process, which we are considering here, is of comparatively recent origin. Die-castings in their correct sense were first commercially produced by the Franklin organization in 1892, and from a very modest beginning the industry has grown to a very considerable size in this country. While the die-casting industry was being developed in the United States the permanent mold process was being developed throughout France and England. The die-casting plants now operating in Europe are the importations of the American process while the permanent mold process has been introduced from France and England into this country.

In the case of the die-casting process the equipment may be divided into three main units as shown at *A*, *B* and *C*, Figs. 1 and 2.

(A) The casting machine in which the molten metal is held and through which it is forced.

(B) The vise that holds the die or mold in place on the machine.

(C) The die in which the casting is formed.

Die-casting machines are of two general types as regards the method of forcing the metal into the molds. They are the plunger and air types. In Fig. 3 is illustrated one of the earliest plunger-type machines, as used by the Franklin company as far back as the early days of the industry and on which practically all the other types are based. There is shown at *A* the main furnace body in which the oil or gas burners by which the metal is heated are contained; and at *B* the outer metal pot in which the main supply of metal is held the top of the metal being kept flush with the underside of the cover *E*. At *C* is shown the inner or plunger pot into which the metal passes through opening *C'* and where it is held while lever *G* is in the position shown by the full lines. As lever *G* is drawn

This is the first of a series of articles. Others will appear in forthcoming issues.

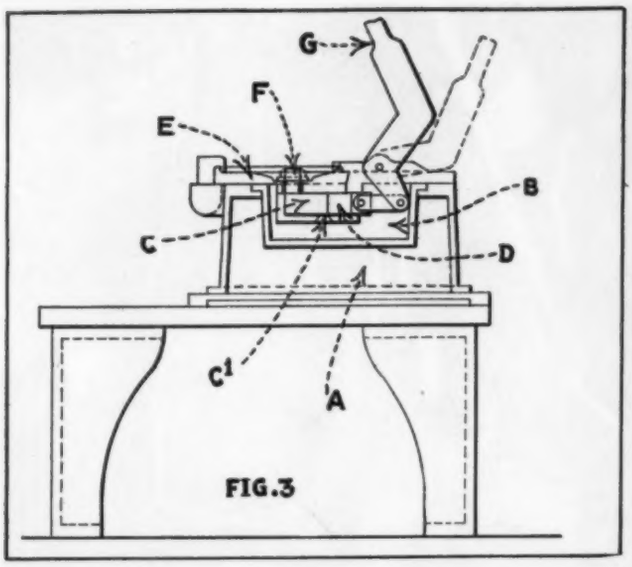
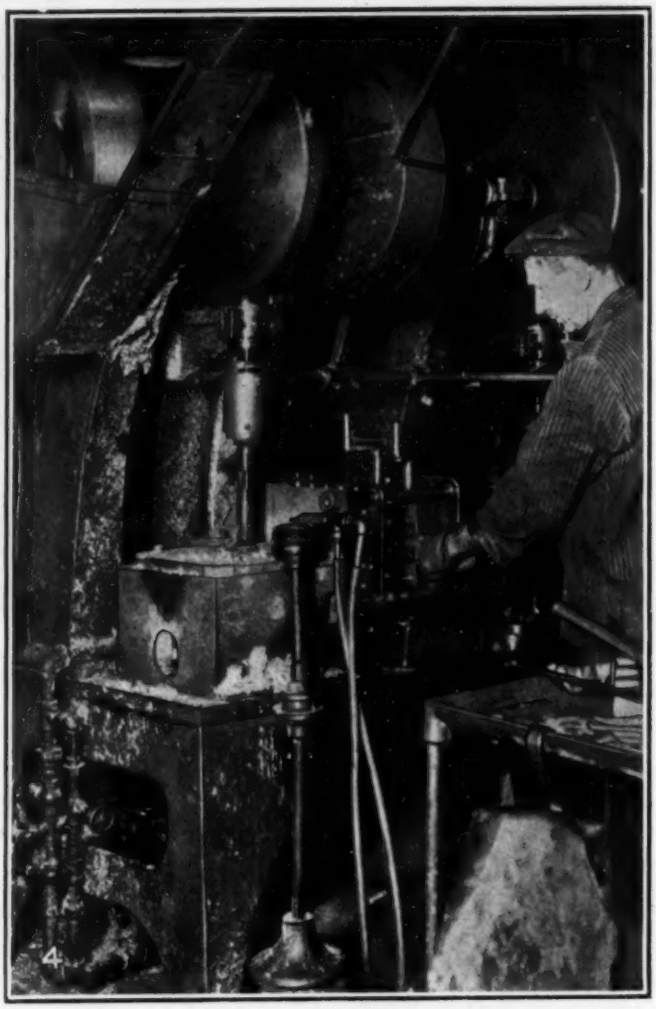


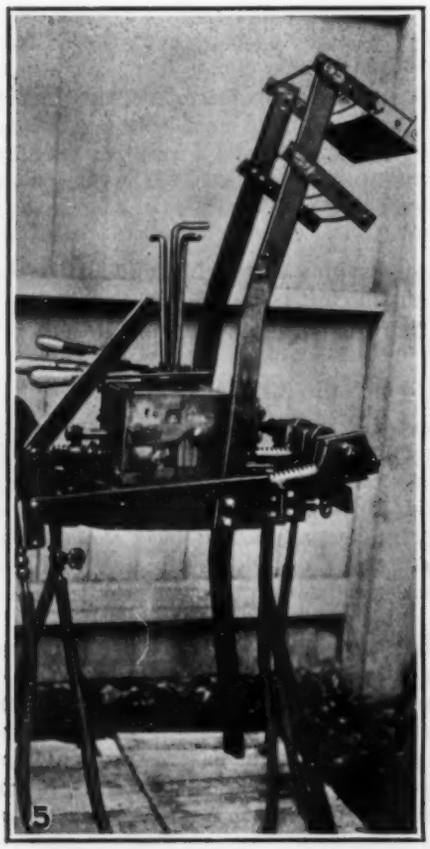
FIG.3

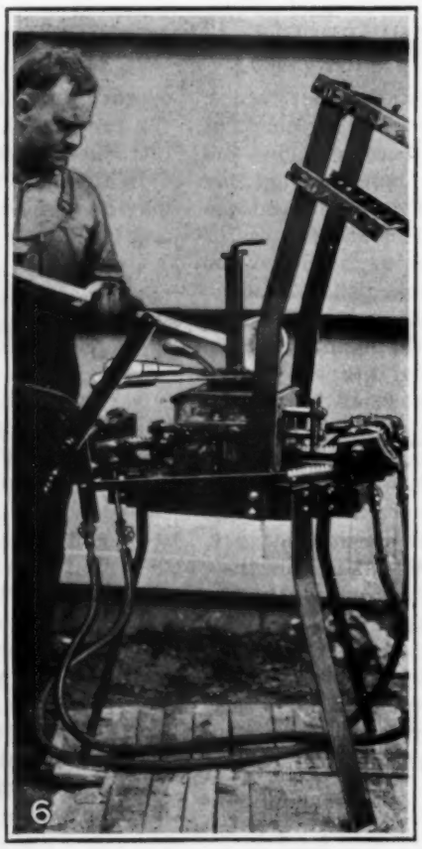
Fig. 3—Plunger type of die-casting machine

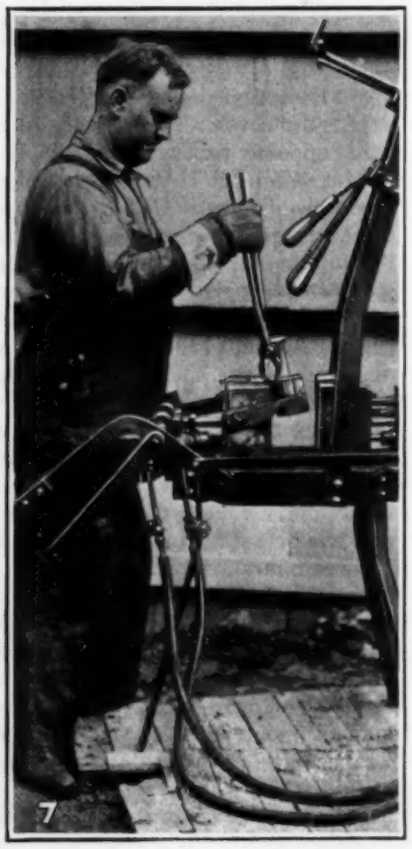
Fig. 4—Horizontal, semi-automatic die-casting machine

Figs. 5, 6 and 7—One-man permanent-mold machine ready for operation, casting being poured and mold open with casting being removed.









back to the position shown in dotted lines, plunger *D* is forced forward and the metal thereby trapped in plunger pot *C* is forced through the nozzle *F*, which communicates directly with the die placed above the cover *E* and locked in position. The die is not shown in the illustration.

The general principles of the air-type machines are much the same. The outer furnace contains burners for melting the metal as in the case of the plunger-type but in place of the outer and inner metal pots a gooseneck, connected directly with the air line, is generally used. The metal may be poured into the nozzle and shot back into the die, or as in some machines, the metal may enter from an outside pot through valve openings. In others the gooseneck is submerged between the operations of casting. The other principles relating to the operation of casting are the same as for the plunger-type machines, the air valve taking the place of the lever while air pressure takes the place of the plunger. Die-casting machines may be either tilting or horizontal; a tilting machine has been shown in Figs. 1 and 2, and a horizontal semi-automatic machine is shown in Fig. 4. The dies may be opened or closed by hand, cam mechanism or air.

Permanent Mold Equipment

The equipment required for the production of permanent-mold castings is less complicated. Figs. 5, 6 and 7 show a one-man outfit used by a manufacturer for the production of pistons, Fig. 5 showing a mold mounted on a framework ready for operation. The mold is heated to the proper temperature and the metal, which is melted in a separate furnace, is poured in as shown in Fig. 6 and solidifies. The mold is then opened as shown in Fig. 7 and the casting is removed. The same degree of accuracy is not possible with the permanent-mold process as with the die-casting process, but for many types of castings, including automobile pistons, the process has been found of particular advantage because it furnishes a smooth, close-grained casting easily machined and with a lower percentage of spoilage than in the case of sand castings.

The Scope of Die-Casting

It is difficult to fix the scope of die castings. For instance, the average die-casting manufacturer would hardly think of approaching a candle manufacturer in soliciting business, and yet one candle manufacturer has used die-castings in connection with the base for altar candles.

Various cigar and confectionery firms have used die-castings in the manufacture of equipment for vending their product.

The automobile field has offered possibly the widest range of uses for the product.

Die-cast bearings, used extensively in automobile engines, may be considered as one of the economic bearing developments of the age. A finished babbitt bearing made from any one of the various bearing metals, cast accurately to size, and having a hardness due to the pressure under which it is cast and the accompanying chilling from the die, makes one of the finest bearings obtainable. The chief danger to be met with is the designing of a bearing that will be too thick. A babbitt bearing, being softer than bronze, should not as a general rule be over $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in thickness. Many firms have disregarded this fact in designing their bearings, with the result that the bearings were found too soft. The origin of the babbitt-lined bronze shell can probably be traced to this cause.

In addition to bearings, die-castings were early found of use in connection with the framework for magnetos, lighting systems and various automobile accessories. With the coming of the aluminum alloys the use of die-castings in the automobile and accessory field was still further increased.

Among the various other fields in which die-castings have been found of especial value may be mentioned:

Farm equipment, such as cow-milkers and cream separators.

Household equipment: percolators, vacuum cleaners, electric fans and washing machines.

Office equipment: dictaphone, typewriters, adding and accounting machines.

Electrical equipment: telephone, telegraph, radios and various recording instruments.

Musical instruments: the phonograph and piano player.

The use of die castings has followed the development of the moving picture from the old days of the biograph through to the modern moving picture machine and has done much in the development of this industry.

During the war the government found extensive use, both for zinc and aluminum castings. They were used in the manufacture of shrapnel, trench periscopes, field ovens, airplanes, depth and smoke bombs and countless other equipment developed during the war.

(To be continued)

What Is a Used Machine Tool Worth?—Discussion

By R. Cowan

On page 670, Vol. 61, of the *American Machinist*, the editor points the way toward determining the resale value of a used machine tool, but I do not think he has made it quite plain enough to convince all machine owners that it is the right way. I consider the machine-hour basis a very satisfactory one upon which to calculate resale values, since no cut-and-dried rule can take into consideration the treatment a machine has received from its operators.

I have recently had occasion to compare the value of two engine lathes of about the same size, one of which has had almost twenty years of service, averaging eight hours per working day, while the other is but about three years old, is of equally good make and is correspondingly more modern in its appointments. The former machine is now the much more accurate and reliable, yet, seeing them both in the "grave-yard" and covered with equal amounts of dust, who could blame a dealer for applying a little psychology—as Harry Ensminger so entertainingly calls it in his article on page 158—in order to get the best of a bargain.

The automobile dealers that are still in the game can, and do, see to it that the market values of "trade-ins" decrease at a yearly rate that would make Mr. Ensminger's head swim if applied to machine tools. Think of marking off 40 to 50 per cent the first year and 10 to 20 per cent per year for three or four years more.

Some dealers sell used machine tools to small shops as teasers; which is wrong, for such shops should have the good tools. Few of them have good lathesmen, and it is a well-known fact that poor tools and indifferent workmen make a combination discouraging to trade.

See Your Banker Before You Start in Business

BY C. J. MORRISON

Each year a number of manufacturing plants are started by men who have formerly been employees, but who wish to start out for themselves. Each year many of them fail. Frequently the savings of years are lost and the losers must start all over again as employees. They are no longer young and the hardships are difficult to bear. Sometimes a position must be taken that is not as desirable as the one which was given up.

These enterprises fail largely through lack of financial knowledge, and yet the best of advice could have been obtained free of charge if it had been sought. Bradstreet's tabulations, taken over a period of years, show that one third of the failures are due to lack of capital. The owners of these enterprises usually invest nearly all they have in machinery and equipment. The balance of their capital is soon used up by paying wages and bills for materials. They find themselves, presently, in a position with some orders on the books, a few accounts receivable and considerable work in progress, but with no ready money with which to pay wages and current bills.

About this time they go to the bank and are surprised to find that they cannot borrow and do not understand, even when they are told, that what they need is not a loan, but capital. The banker may suggest that they look for a man with money and take him into the business, but many of those in trouble object to dividing the profits they expect to make.

THE BANK STANDS READY TO GIVE SERVICE

The result is inevitable and soon their assets are sold for about ten cents on the dollar. The equipment usually goes to some dealer in used machinery and he may later sell it to someone else who will probably go through the same process, unless he is properly fortified.

The way to prevent these failures is for those who are thinking about starting in business, to go to their banker and explain their plans to him before resigning their positions or spending any money. Today, most large banks employ specialists who are thoroughly competent to go into the details of a proposed enterprise and to give good sound advice. These men have had experience in many lines of industry. They understand market conditions and credits. They know how to estimate costs. They probably have, although they will not say, detailed figures of enterprises in the same line as the one proposed. They can show a client exactly the capital which he will require and how he should proceed with his enterprise, or they can tell him frankly to stay out of it.

Bank officers are the easiest persons in the world to see in this present age. All anyone has to do is to walk into the bank, tell one of the attendants what he wants, and he will be directed to the proper person. It is usually not even necessary to make an appointment or to go through any of the old-time red tape. No one need fear that anything he has to say will be revealed to anyone else. Bank officers know how to keep business confidences or they would not hold their positions.

Remember that the bank would like to see you start in business and succeed. That would mean profit for the bank. A failure means a loss for everyone. Banks are in business to make money and they make it by lending credit to enterprises which succeed so they are vitally interested in helping persons to succeed.

Go to the bank before you start in business.

Grinding Wheels and Precious Stones

The fact may not be appreciated by many of us as we start up the old "emery-wheel" to grind our lathe or planer tools, drills, or whatever implements we may have in hand that need to be resharpened that the homely and familiar device we handle so carelessly may be very closely related to the so-called precious stones.

For many years corundum—or its somewhat degenerate relative, emery—was practically the only medium other than sandstone that was available for the purpose of making abrasive wheels, and the natural

Natural corundum crystals of the "gem" class

corundum crystal is separated only by accident of birth from the ruby, sapphire, emerald, garnet, topaz and other valuable stones.

Chemically considered, corundum is an oxide of aluminum (Al_2O_3). It is found in many parts of the United States, in Spain, France and Norway, and in South Africa, from whence comes the principal part of the world's supply. Though vast numbers of corundum wheels are still used in certain industries—notably in the manufacture of optical goods—the material has largely been superseded by the artificial aluminous oxide called alundum; which differs from corundum principally in the fact that it is made in man's laboratories instead of those of nature.

The natural corundum crystal is deposited in the form of six-sided or hexagonal prisms, surprisingly regular in contour but varying widely in size.

A pure crystal of corundum would be almost white, but such crystals are rarely found. Common crystals are of a greenish-gray color. Occasionally an otherwise nearly pure crystal will be "contaminated" by the presence of iron, chromium or other mineral, and will become a ruby, a sapphire or other precious stone. The illustration shows some of the gem stones that have been culled from the supply of raw material delivered to a manufacturer of wheels and abrasive materials.

Automotive Production

High Production Machines in the Automobile Shop

The third of several articles describing special machines developed primarily for automotive production

Ingersoll Traveling-Head Milling Machines

IN THE previous articles discussing the features of special machine tools developed for use in the production of automotive units, single machines were described. Here, however, we come to a different situation in that the machines mentioned are each a modification, for a definite purpose, of a general design principle. The milling machines illustrated are typical of the kind of special machine design carried on by the Ingersoll Milling Machine Co., Rockford, Illinois.

For certain types of production work it has been found economical to split up what might be called multi-operation jobs and have each operation performed separately on a single-operation machine that can be driven to the limit. Careful analysis is necessary, of course, to determine whether the one big, expensive, multiple machine or several simpler units will do the job most economically. It is probable that the single-purpose machine group will require more operators but on the other hand there is usually a smaller investment and less trouble from machine breakage.

Fig. 1—Machine for milling valve cover pads

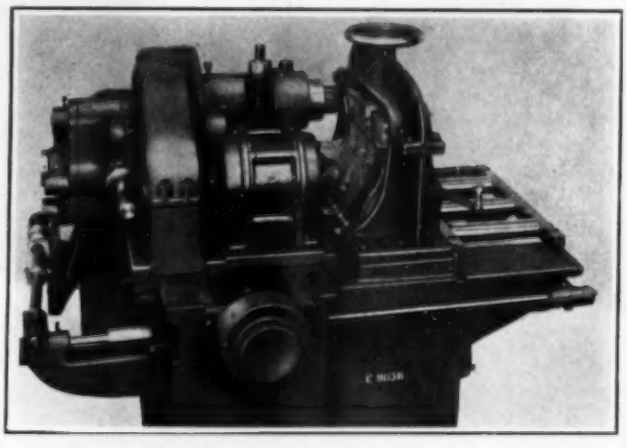
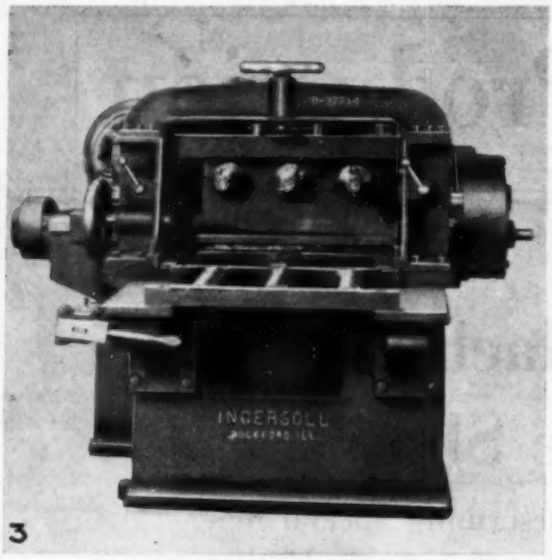


Fig. 2—Machine for milling water-pump pads

It is not the purpose here to go into the merits of either type of machine. Under certain conditions one type is indicated, under different conditions the other type. The machines described in what follows are of the special single-purpose variety.

In order to meet the demand for a machine that can do a small milling operation on a casting, do it quickly, economically and without much lifting of pieces by the operator, the "traveling-head" milling machine has been developed. Another requirement of the designer was that the units should either fit into the conveyor line or else be so close to it that material handling should be a minimum. An economical use of floor space was also a factor.



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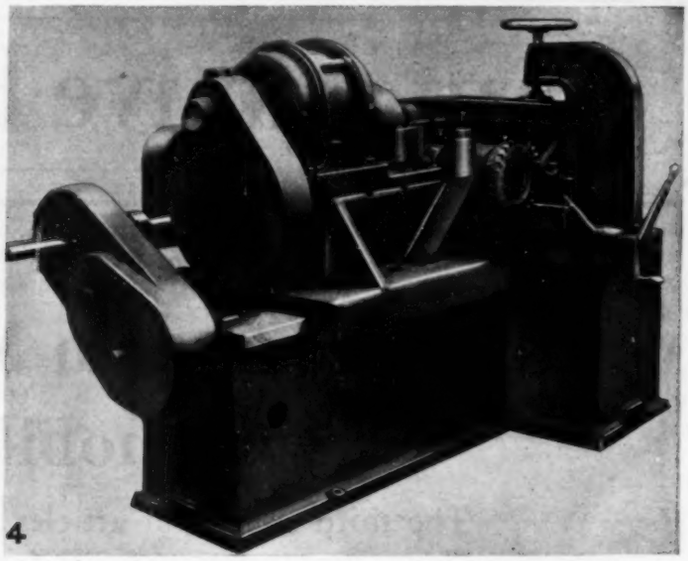
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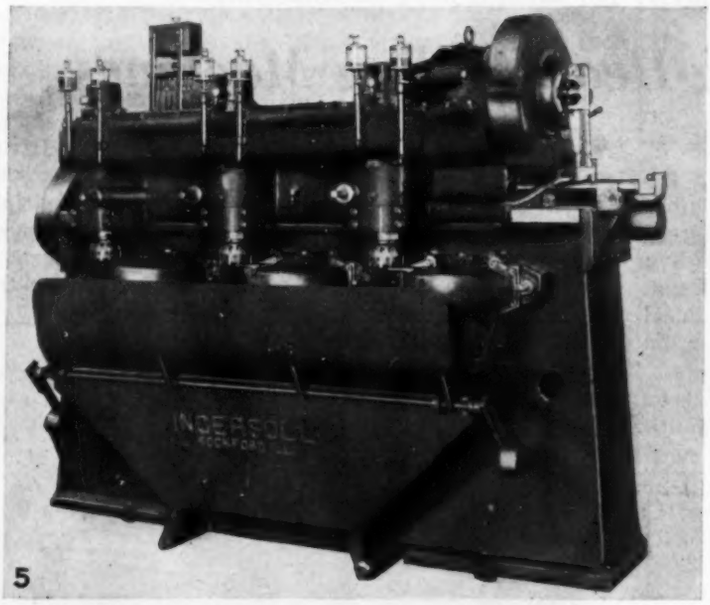

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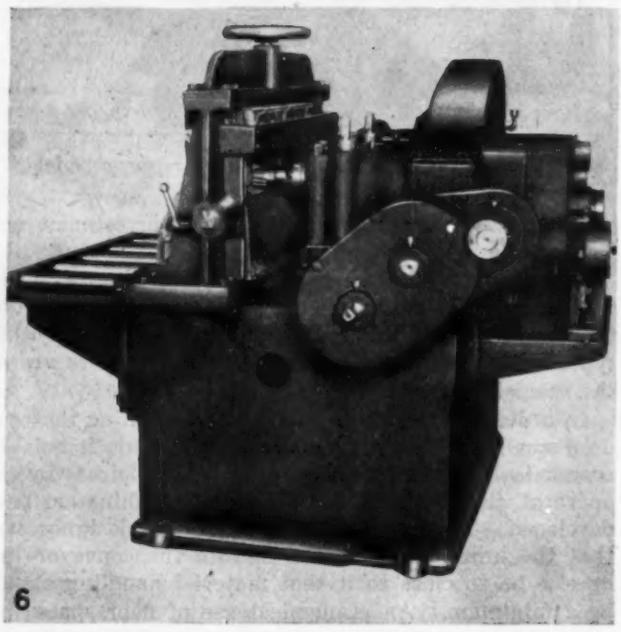
Fig. 3—Three-spindle miller for finishing valve tappet bracket bosses

Fig. 4—This machine mills the generator support arm

Fig. 5—Three-spindle machine for milling starter pads

Fig. 6—Two-spindle miller for the same type of work as the one in Fig. 3

Fig. 7—A machine for milling three main bearings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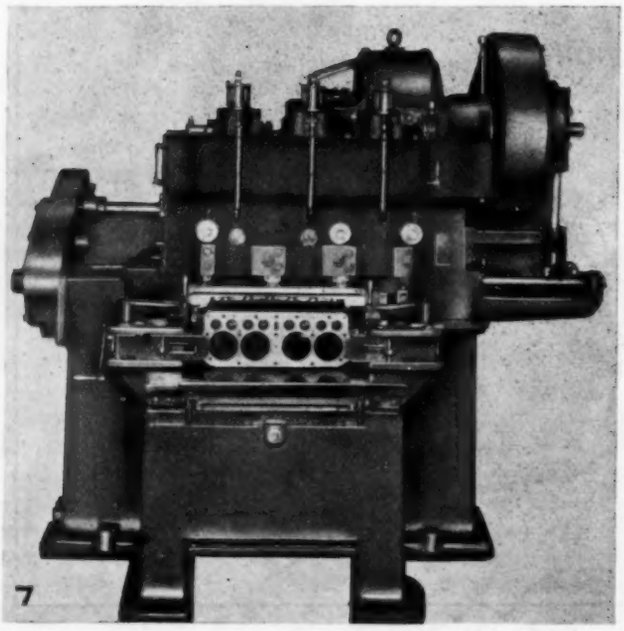
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AUTOMOTIVE PRODUCTION

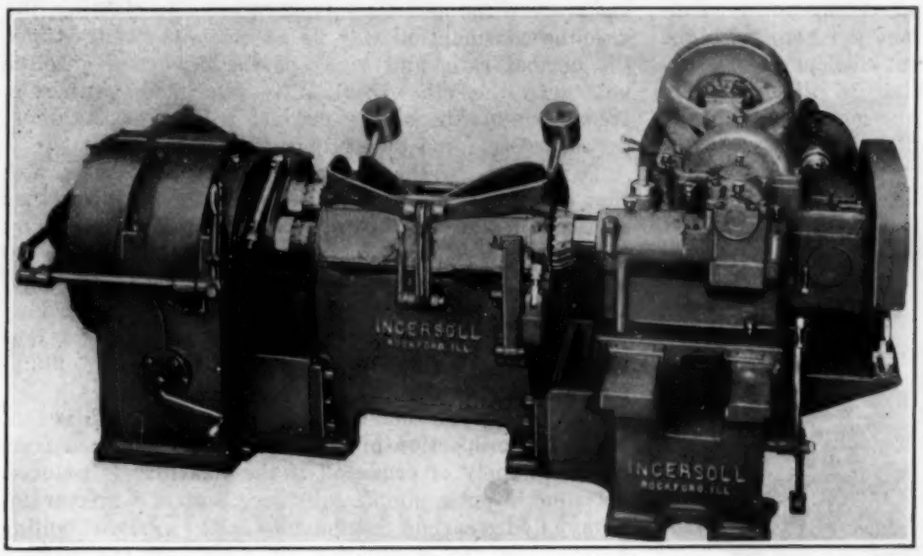


Fig. 8—Combined sliding-head and rotary-head miller for crankcase ends

In all of the tools shown the head or saddle travels on ways and thus moves the cutters across the stationary work. The drive and feed mechanism in each case is mounted on the saddle. Most of the tools illustrated are semi-automatic in their operation, the heads either stopping at the end of the cutting portion of the cycle or else completing the cycle by returning to the original position. Each one is a special machine built for a particular operation.

The first machine, Fig. 1, mills the valve cover pads on a six-cylinder engine block. It is built in as a part of the conveyor line. The casting rolls onto the table, the table rollers are lowered thus allowing the casting to rest on the fixture and it is then locked in position. The casting is fed in to the cutter and against a stop by the handwheel. The feed is then engaged and the cutters move from one end of the pad to the other, return to the starting point and stop ready to commence the next cycle.

Another machine that fits into the production line is shown in Fig. 2. Operated by one man, it is strictly a single-purpose machine for milling water-pump pads on cylinder blocks. The work is shown in place in the fixture. As it comes along the conveyor line the operator pushes it back off the rollers into the fixture and locks the clamps. The cut is completed and the piece is back on the conveyor line in one minute. The feed is thrown in by hand and stops automatically. The weight of the machine is 6,000 lb. and it occupies 24 sq.ft. of floor space. Its production at 90 per cent efficiency is 500 castings in a 9-hr. day.

A machine of much the same type is shown in Fig. 3. It has three spindles and is designed to mill valve tappet bracket bosses on a six-cylinder block. Still another machine of this type is shown in Fig. 4. The illustration shows the cutter in working position ready to finish mill the generator support arm on a cylinder block casting. Operation is semi-automatic.

A somewhat larger unit is the subject of Fig. 5. It differs from those described in that it sits beside instead of in the conveyor line. Its function is to mill starter pads on transmission covers and it turns out 650 castings each 8-hr. day.

Going back once more to the type of machine that fits into the conveyor line we have another example in Fig. 6. It is a two-spindle miller for facing the valve tappet bosses on a different type of cylinder block.

The machine shown in Fig. 7 is a three-spindle type for milling crankshaft bearings in a four-cylinder engine block. It is designed to be set alongside the conveyor line so that the operator can slide the castings off the conveyor directly onto the machine table. Automatic reversible power feed, with hand adjustment and adjustable stops, is a feature.

A somewhat more complicated unit is shown in Fig. 8. Its function is to rough and finish mill the circular ends of crankcases and to finish mill the opposite ends. The fixture is shown loaded and locked. For performing the operations on the circular end of the crankcase two cutters are mounted on the spindles in the rotary head shown at the left. The single cutter for finishing the opposite end is mounted on a spindle carried in the sliding head shown at the right. When the fixture is loaded the feed is thrown in and the cutting cycle continues until automatically stopped.

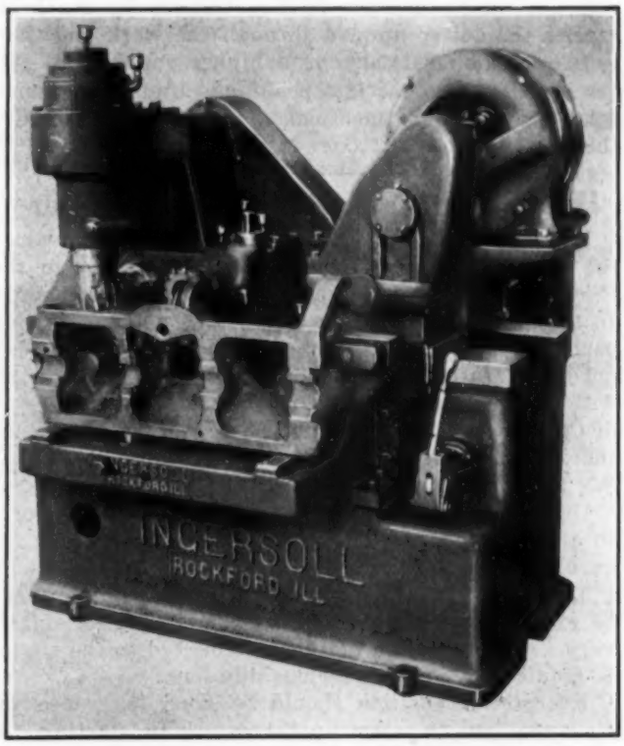


Fig. 9—Machine with both vertical and horizontal heads for generator pads and water-pump brackets

AUTOMOTIVE PRODUCTION

The cycle can be stopped by hand at any point. Production is at the rate of 20 castings per hour with the machine functioning at 90 per cent efficiency.

Another traveling-head machine is illustrated in Fig. 9. Its job is to finish mill the generator pad and water-pump bracket on six-cylinder crankcases. After the operator has loaded the fixture he throws in the feed and the cutting cycle continues until completed.

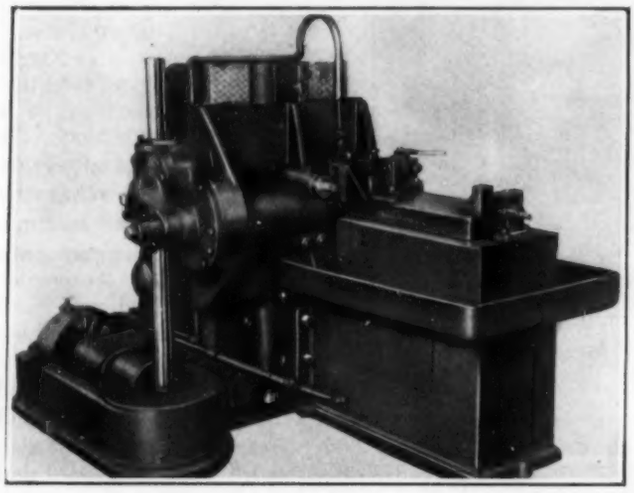


Fig. 10—A traveling-head miller for front axle forks

The cutters are then returned automatically to their original position by a quick-return mechanism. At 90 per cent efficiency production is 45 castings per hour.

The last of the traveling-head machines to be shown is the subject of Fig. 10. Its function is to mill the fork on a passenger car front axle. With the axle in place in the fixture the feed is thrown in, the head carries the cutter upward through the work and then returns it automatically at a higher speed to a stop that marks the starting position. Under the same efficiency conditions mentioned for the other machines this one turns out 122 axles in a 9-hr. day.

Hot Jacket Water Best for Automobiles

Hot jacket water in automobile engines helps reduce the thinning of the lubricating oil, according to the Bureau of Standards, of the Department of Commerce. In a cool cylinder, the bureau explains, the fuel is only partially vaporized, and the unvaporized gasoline does not burn. Instead, it remains in the cylinder and mixes with the oil, and is carried into the lubricating system of the engine. After awhile the oil becomes so diluted that its lubricating value is seriously impaired, and it has to be replaced.

Dilution may also be lessened by high temperatures in the crank case oil, as heat tends to separate the gasoline from the oil.

The loss of efficiency accompanying this dilution may be extremely small, the bureau points out, for only a very small proportion of the gasoline fed to the engine is required to produce serious dilution.

Everything possible should be done to reduce the time required to warm up the engine in starting, the bureau states, as dilution has been found to take place much more rapidly when starting than after the engine has reached its operating temperature. In starting, the gasoline consumption may be as much as twenty times the normal rate, and much of the unburned gasoline gets into the oil. Dilution is also made worse by frequent starting of the engine, with alternate short periods of use and of cooling off.

Tests made by the Bureau of Standards have shown that crank case dilution is the greatest drawback to a decrease in the volatility of gasoline. For several years the bureau has been engaged in a series of tests to determine the effect of such a change on engine performance, and has found that when once warmed up an engine using the less volatile grade will give as many miles to the gallon as one using the grades obtainable a few years ago.

The reason for such a change, it is explained, is that a greater proportion of gasoline can be obtained from a given supply of crude oil if the volatility is reduced. Gasoline is not a simple substance, but is a mixture of many hydro-carbon compounds with various boiling points. In the distillation of crude oil the various products are separated according to an arbitrary scale of temperatures. Everything that condenses between certain temperature limits is classed as gasoline, everything condensed between the upper limit of gasoline and a still higher temperature is kerosene, and so forth. By raising the upper limit of gasoline the distillation process can be made to yield more gasoline and less kerosene per barrel of oil.

Perfect Castings Made Possible by New Method of Controlled Heat

Some of the most important developments in industry have never been advertised, except indirectly through an increase in quality of manufactured goods or a lowering of prices to the purchaser, according to the American Gas Association.

The manufacture of automobile spare parts has reached a point now where thousands of pieces can be turned out by automatic die-casting with a degree of accuracy that was unknown a few years ago.

Formerly these parts had to be machined, after casting, with the utmost care. Today they are taken from the die already conforming to the most minute specifications.

Manufactured gas, which is the modern scientific fuel of industry, has been largely responsible for this perfection, as a result of which some of the largest die-casting companies have converted their entire plants to high pressure gas.

One of the principal advantages of gas in this work is that it prevents the cracking of the original dies, that are often very intricate and costly. The cost of the intricate dies increases the final cost of the castings, so that these castings must be made in large quantities to be economical.

These dies must be cooled after each casting so that the new metal will be chilled quickly and have the fine grain required for a strong product. The die is, therefore, alternately cooled and heated, and if it has not received the proper heat treatment, the fatigue of the metal will quickly destroy it. To attain this end complete control of the fuel supply is essential.

Reclaiming Scrap on the Santa Fé

By R. K. Graham
Gen. Supt., Reclamation Plant, A. T. & S. F. Ry., Corwith, Ill.

How discarded materials are saved from the scrap-pile—Rolling scrap into bars—Utilizing discarded roofing—Repairing valves and air-brake parts—Final disposition of scrap

SCRAP-PILES represent money—money that is generally considered as lost forever as a result of spoiled material, wasted labor-hours, breakage or wear beyond the point of usefulness. Some 15 years ago instructions were issued by M. J. Collins, general purchasing agent, under whose jurisdiction the reclamation plant functions, that all scrap material be gathered from the various points and forwarded to the Corwith yards, near Chicago. There the scrap was sorted in order that the highest prices might be obtained from the junkman, a dismantled box-car being used as the headquarters for the sorting gang. It was discovered that a large part of the material being sold as scrap could be repaired or worked into other usable forms at a comparatively small cost, and this practice has been developed until, today, the reclamation plant covers 26 acres of ground and comprises two large brick buildings and a number of large and small steel-frame buildings covered with sheet iron. In keeping with its object, the plant as a whole has been constructed of discarded materials. The brick buildings were constructed from bricks picked up along the right-of-way when cleaning up the yards, or salvaged from other buildings or structures that had been altered or torn down. The steel framework used in many of the buildings was fabricated from the beams and other structural shapes from discarded bridges and old buildings. The roofs and sides of the buildings are of sheet-iron roofing from wrecked or dismantled freight-cars—scrap material that cost practically nothing, but entirely satisfactory for the purpose for which it was used.

From ten to twenty carloads of miscellaneous discarded material a day, or approximately 8,000 tons a month, is received at the yards. This consists of all kinds of iron and steel, brass, copper and other scrap, discarded tools and equipment such as shovels, picks, track drills and lanterns, all kinds of air and steam valves, hose, paper, felt, glass, and so on through the long list of materials used by a great railway system. This material is sorted approximately as follows: (1) Equipment and parts that can be repaired to make them usable at a reasonable cost; (2) materials that can be worked into other forms at comparatively small cost; (3) materials that are in such condition or of such nature that they cannot

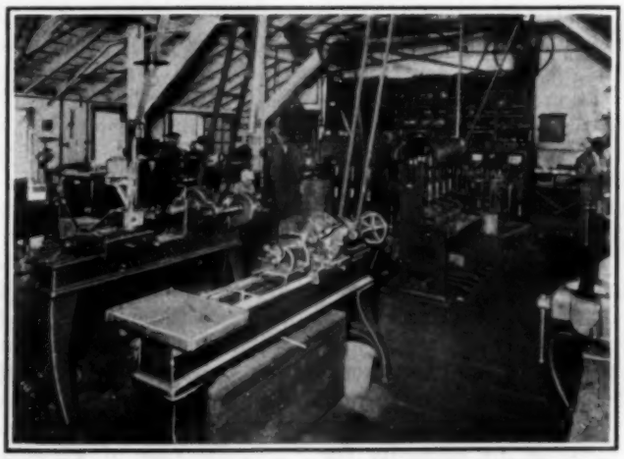
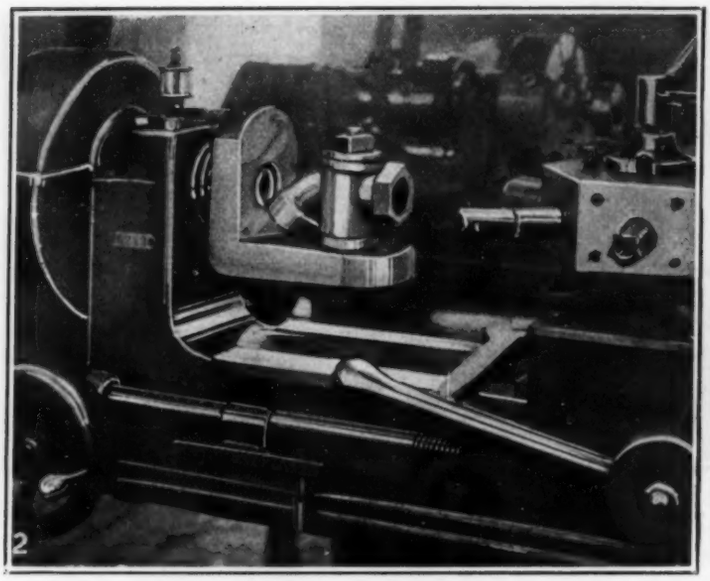


Fig. 1—Air-brake equipment and valves are reclaimed here



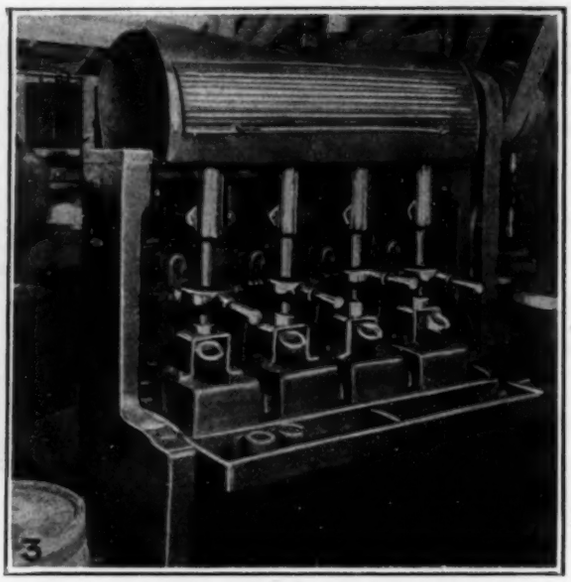


Fig. 2—Boring and retapping a valve. Fig. 3—Grinding angle-cocks

readily be put into any useful form and therefore possess only a scrap value. Materials in the first two classifications are repaired or reclaimed accordingly and those in the last are properly sorted and put into shape so as to bring the highest market price as scrap.

All incoming material is weighed and the cars are then switched to the different unloading points in the yard, depending on the nature of the material they contain. That is, brass and other non-ferrous scrap is unloaded at one place, sheet metal at another, heavy iron at another and so on. The space allotted for the sorting is shown in the headpiece of this article, although at the time the photograph was taken, the piles were pretty well cleaned up. As the materials are sorted, they are thrown into the large buckets shown standing in line, which are afterward picked up by the cranes and distributed to the various departments where they will be reclaimed, or in the case of scrap, the material will be dumped into other cars according to classification. The handling job is taken care of with four Industrial Works cranes and one Brownhoist crane. Three of the cranes are fitted with electro-magnets, the current for which is obtained from a motor-generator set, and conducted through an underground distribution system to a number of outlets fitted with Ralco power receptacles, located at intervals along the tracks. Current is conducted from the outlets to the magnets by 200-ft. lengths of cable. A gasoline-engine driven, Industrial Works crawler-type crane is also used for piling sorted scrap and doing other work of like nature around the yard.

A large amount of both cutting and welding is done in the shops and yard by means of the oxyacetylene torch. Gas for the torches is supplied from a central acetylene-generating station having a rated capacity of 800 cu.ft. of gas per hour. Both acetylene and oxygen are piped from this station, the former at a pressure of 9 oz. and the latter at 50 lb., to the various shops and outlets in the yard—a total of 36 stations. The torches used in the yard are connected to the outlets by lengths of rubber hose of, usually, 100-ft. lengths. This arrangement obviates the necessity for transporting gas tanks about the yards.

There are six main departments in the plant—the valve shop, hose department, blacksmith shop, bolt shop, tin shop, and rolling mill. When the incoming materials are distributed, the material that comes under the first classification (parts that can be repaired) is sent to the department in which it can easiest and best be repaired. For example, trainmens' lanterns are thoroughly cleaned, bent or broken parts are straightened or replaced, new globes are put in and the lanterns are finally sent back to stock quite as good as new. Shovels and forks are straightened and fitted with new handles. Tamping picks are likewise dressed, tempered and new handles put in, if necessary. Steam and air valves are washed to remove all grease and dirt and are then taken apart and carefully inspected for wear and defects. Wheels, stems, packing nuts and other parts that are broken or worn are replaced and the threads are retapped if necessary. The valves are then given a rigorous test and if they stand up satisfactorily they are sent to stock. In the same way ells, tees and other fittings are washed, the threads retapped if necessary and after careful inspection are sent to stock. Air-brake equipment is thoroughly overhauled, inspected and tested with great care before it is returned to service. Fig. 1 shows the department in which this work is done and Fig. 2 shows a 1¼-in. angle cock on a Warner & Swasey hand screw-machine, in position to have the threads bored out. The hole will then be retapped for a 1½ reducing bushing and the cock will be ready for use again. The angle-cocks are ground in the machine shown in Fig. 3. This is an old nut-tapping machine that has been rigged up for the job in question. The work-holders were forged in the blacksmith shop and consist of inverted U-shaped pieces that hold the cocks from turning. There is a stud in the lower end of each spindle. to which the cock-plugs are attached. A small shaft has been added at the rear of the machine, with eccentrics that raise the spindles at each revolution of the shaft, so that the cocks will be ground without the formation of rings. Each spindle is arranged so that it can slide up and down in its bearings.

In the case of wheelbarrows, frames and rivets are tightened, new wheels put in if necessary, and any other needed repairs are made. Track spikes are straight-

ened under a power hammer and are tumbled to remove rust. Nuts are retapped; bolts are straightened, and if the threads are battered, they are cut to a shorter length and rethreaded. Truck and body bolsters that have been cracked in service or damaged in wrecks, are gas welded and after being annealed to relieve stresses, are returned to service. The list of equipment and parts repaired and returned to service covers a larger number of items than would be supposed by anyone not familiar with the great variety of articles used by railroads.

The second group in the classification covers material and parts that can be worked into other forms. As an example, old boiler tubes are cut into suitable lengths, flattened in a set of rolls and punched into washers of various size. Light scrap sheet-metal such as smokejacks, small stacks, etc. are composed of, is also punched into washers using the punch press shown in Fig. 4. Washers from $\frac{3}{8}$ in. up to 2 in. in diameter are made of such scrap. The heavy, galvanized iron discarded from freight-car roofs goes to the tinshop, shown in Fig. 5, where it is cleaned and made into oil cans of from $\frac{1}{2}$ to 10-gal sizes; water-buckets, grease-buckets, stove-pipe, way-car smoke jacks and other kinds of railroad sheet metalware.

Most of the round and flat wrought-iron material that comes in is cut into short lengths and made into bundles or fagots. It is then heated to a welding temperature and rolled either into round bars of from $\frac{7}{16}$- to $1\frac{1}{4}$-in. diameter, or into flat bars as large as 1x4 in. The rolling mill equipment consists of a 9-in. mill driven by a 300-hp. steam engine and a 12-in. mill driven by a 500-hp. engine. These mills will roll round stock up to 2 in. diameter and flat stock up to 1x5 in.

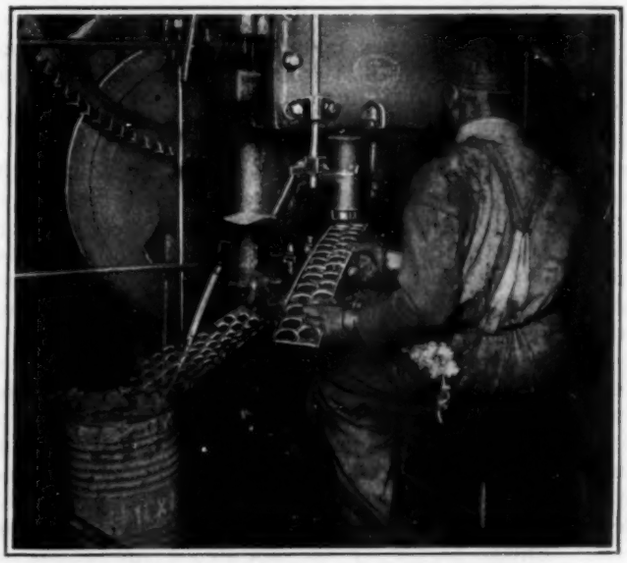


Fig. 4—Making washers from sheet scrap

The fagots are weighed as they are made up and the weights are gaged according to the size bar that is to be made.

From 60,000 to 90,000 lb. of iron is rolled per day; the round bars to be made into car and engine forgings, bolts of various sizes, coupler release rods, and so on and the flat bars to be made into coupling yokes and other forms. Although car axles are now made of steel, any old axles that come in are rolled down to a size that will meet some particular requirement. Journal brasses are heated to a sufficiently high temperature to melt out the babbitt, which is melted into pigs and used again, with the addition of some new metal. If the brasses are not too badly worn, they are sent to an outside concern for rebabbitting; otherwise they are sold as scrap metal.

Waste that comes under the third classification and possesses only a junk or scrap value covers a wide

Fig. 5—Salvaging discarded car-roofing

variety of material, inasmuch as it includes everything that does not come under the other two classifications. In all cases, however, this material is carefully sorted and given whatever treatment is necessary to enable it to be sold to the best advantage. For instance, large quantities of worn-out dry cells that have been used for open-circuit signal work and which come in with the scrap, are broken up so that the zinc shells can be melted and cast into pigs. The brass connectors are removed from the carbon electrodes and sold as scrap brass. The lead salts are removed from old storage-battery plates and sold, while the plates themselves are melted and cast into pigs. Brass turnings and borings are passed through a Dings separator to remove iron particles. Other brass scrap is carefully classified according to the various grades. The insulation is burned from copper wire and cable that is not otherwise usable, and the wire is sold as scrap copper. Burned-out incandescent lamps with unbroken bulbs are often sold to lamp manufacturers. Glass, comprising broken window panes, bottles, incandescent lamp bulbs and so on is collected and sold to glass makers. Waste paper is sorted, baled and sold to dealers. Burlap, felt, etc., are likewise sorted, baled and sold. Scrap material is disposed of to the junk dealer making the highest bid.

Materials that have been worked over or reconditioned are sent to the points where they are needed. Once a month the purchasing department issues a list of the materials and supplies that have been requisitioned by the various storehouses and other departments of the road. Items that can be furnished from the salvaged stock are taken from this list and requisitions are then issued to the reclamation stores by the department that needs the material. The material is then forwarded to the department requisitioning it, a charge being made equal to the prevailing market price for the class of material supplied.

Exhaustion of Patents Deductible on Tax Return

By Leslie Childs

THE question of the right of a taxpayer to deduction for exhaustion of patents used in the conduct of its business, under the Revenue Act of 1918, was passed upon by the United States Board of Tax Appeals in the recent case of Appeal of the Union Metal Manufacturing Co. And in view of the importance of this question to the owners of shops, factories, and other establishments, that list patents as assets in the operation of their enterprises, the decision seems well worth a brief review. The facts and circumstances that culminated in the action were, briefly stated, as follows:

The taxpayer, the Union Metal Manufacturing Co., was an Ohio corporation engaged in the business of manufacturing certain metal products, under patents owned by it. These patents were acquired by it during 1906 to 1908 inclusive at a cost of $38,285.94, and on March 1, 1913, they had a fair market value of $135,000 with a remaining life of ten years, five and one-half months.

Filed Amended Claim

Now, the taxpayer in its original tax return of income and profits for the year 1918 made no deduction for the exhaustion of these patents. Following this it filed an amended return in which it claimed deductions for exhaustion of the patents based on their value on March 1, 1913. The commissioner refused to allow this deduction, determined a deficiency, and the taxpayer prosecuted the instant appeal.

On this appeal the Commissioner urged that patents do not necessarily depreciate and pointed out that during portions of their lives they might give rise to appreciation in the value of the good will of the concern owning them. And it was urged that certain authorities on accountancy, joined patents and good will in one account and carried it from year to year undiminished on the theory that it simplified bookkeeping. From this it appears to have been contended by the Commissioner that the exhaustion of the patents was offset by appreciation in the good will. In passing upon this phase of the question before it the Board, in part, said:

"The combination of patents and good will is proper enough in computing invested capital under those provisions of the statutes in which patents and good will are treated alike, but it does not follow that the same practice will work properly in computing deductions for exhaustion, for patents are by nature exhaustible and good will ordinarily is not.

"It may be true that the exercise of a monopoly, under a patent, may tend to build up a good will increasing in value as rapidly or more rapidly than the patent is exhausted. Good will is something that grows out of the general conduct of the business. It is attributable under different circumstances to any and all of several items. * * * And nothing in the statutes requires or permits the increase in good will value to be offset, in the computation of annual income, against deductions allowed for wear and tear of the machinery. * * * If wear and tear in a building cannot be offset by appreciation in value of the asset itself * * * exhaustion of a patent cannot be offset by appreciation in a different asset, good will."

However, the Commissioner contended, that since in some cases the value of patents diminished with the lapse of time, while in others they did not, the taxpayer's judgment as to the value of patents should at least be *prima facie* the test of value. From this it was urged that in the instant case the taxpayer's original return should constitute an irrevocable classification; from which it was argued that since the taxpayer did not in its original return claim the deduction for exhaustion of its patents, it was precluded from demanding another computation of its tax for a past year on the facts as they existed at that time. In answering this proposition the Board, among other things, said:

Patent Is "Wasting Asset"

"It is unnecessary for us to dwell upon the unsoundness of a rule that the nature of a capital asset may depend upon the mistake of a bookkeeper, for we do not concede that a patent can have more than one nature. It is, of necessity, a wasting asset. It is a monopoly with a definitely and strictly limited life. The benefits derived under a patent may in effect be prolonged by the issuance of new patents, just as the benefits of a lease may be prolonged by new leases—but after the expiration of the original patent, as after the expiration of the original lease, the benefits and values are not attributable to it but to the new ones.

"We have been shown nothing in any of the revenue acts nor in general rules of law to the effect that deductions for exhaustion, wear and tear or obsolescence in the computation of taxable income should be governed by one rule in the case of tangible assets and leases and by another rule in the case of patents. The theory of these deductions is the allowance of a return to the taxpayer of his capital investment before taxing him on a profit derived in part from the exhaustion or using up of his capital. * * *

Patents No Exception

"Section 214 (a) (8) of the Revenue Act of 1918 provides for the deduction of a reasonable allowance for exhaustion, etc. of property used in the trade or business. We know of no ground for holding that this means all property except patents. We not only have no right, but in this case we can find no sensible reason, to write such an exception into the statute. * * *

"The mere failure of a taxpayer to take the proper deduction in each year does not permit him to take advantage of his mistake through an incorrect return in a later year, nor does it permit the Commissioner to compel an incorrect return. The law does not contemplate the adjustment, in any part, of an incorrectly computed tax by the incorrect computation of another tax. Unless barred by the statute of limitations, a taxpayer is not precluded from demanding a correct computation of his tax for a past year on the facts as they existed, whether originally reported, or not. * * * "

In conclusion, after disposing of other issues not material to this review, the Board held that the deficiency should be computed in accordance with the principles of law stated in the above opinion. Holding, in effect, that the taxpayer was entitled to a deduction for the exhaustion of patents, used in the conduct of its business, and further, that its failure to claim such deduction in its original return did not preclude it from claiming of such deduction at a later period.

Methods of Machine Tool Design

By A. L. De Leeuw
Consulting Editor, *American Machinist*

Toolholder design requirements—Six essentials of good design—Good and poor practice compared—Spindle and bearing design—Points that appeal to the buyer

THE main requirements of a good toolholder are the following:

1. It must be so located as to give the least possible amount of overhang of the tool.
2. It must hold the tool rigidly, not permitting it to rock or to be displaced by the pressure of the cut.
3. It must be so constructed as to permit the chips to escape.
4. It must have means of adjusting the tools for the original setting after they have been re-sharpened.
5. It should indicate the position of the tool, so as to eliminate setting or re-setting by repeated trial.
6. In some cases, it should permit the tool to present itself to the work at any desirable angle.

With perhaps the exception of the last-mentioned point, most toolholders are constructed without regard for these requirements. Take, for instance, the well-known toolpost of the smaller and medium size lathes. There is a single set screw holding the tool against a rocking member. The tool point is a long distance away from the screw. There is absolutely nothing in either toolholder or tool which permits its re-setting to the previous position after it has been sharpened, and further, there is not even provision made for the setting of the tool point to the center of the work. When toolholders such as the Armstrong, Williams, or O. K. are used, the amount of overhang and the tendency to rock is still further increased.

Considering the first requirement, that there should be the least possible overhang of the tool, it is impossible to put too much emphasis on this point. Going through almost any machine shop one will find that lathe tools, planer tools, shaper tools and slotter tools are used with very much more overhang than conditions justify. For some reason which the writer has not been able to fathom, the majority of mechanics seem to take a delight in excess of overhang of the tool. Much smaller tools could be used and much better work would be done if tool overhang would always be kept down to a minimum. However, the fact that the shopman generally does not appreciate the importance of short overhang does not justify the machine tool builder in neglecting this requirement. Figs. 279 and 280 show what is being done and what should be done. Fig. 280 does not show the method of holding the tool, but it does show, in a general way, the type of toolholder that should be used whenever possible and which is being used to a large extent on special purpose machines. Not only should the tool have the least possible amount of overhang, but it should be so supported that it can rock neither endwise nor crosswise. That the tool itself is rough and generally is made to bear on a rough surface makes a certain amount of rocking almost unavoidable; but on the other hand, there is no reason why tools should be rough nor why the supporting surface should not be carefully finished, and this brings us to the second point.

A tool should be held by not less than two set screws, or still better, by a wide clamp. It should always be held sidewise by setscrews, and the solid bearing of tool against its support should be on the side where the pressure comes against the tool holder. Various

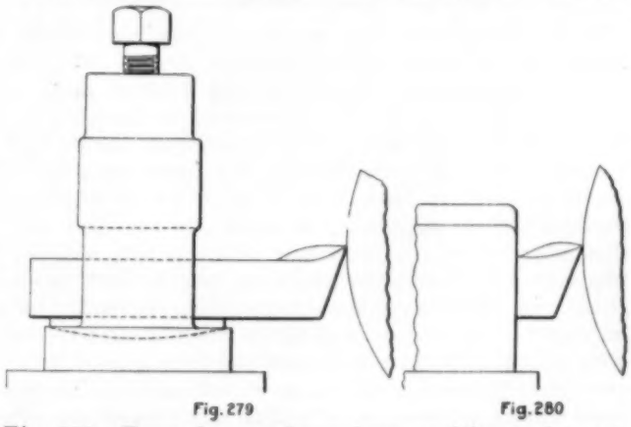


Fig. 279—Excessive overhang from position tool is set.
Fig. 280—Tool set correctly for a minimum overhang

constructions might be used to accomplish this. The tool might be ground at the bottom and at one side, leaving the setscrews to come against the rough sides; or the tool might be made with a taper, with a taper clamp fitting over it. It may be said here that this latter construction would not give advantages commensurate with the expense of the construction except in a few cases, but the top support and side support by means of heavy set screws is essential where heavy or accurate work must be done.

The type of construction shown in Fig. 280 would not permit the chips to escape, especially if they were heavy, unless the top part of the tool holder was cut away in such a manner as to guide the chips without crumbling them. Unless this is done, it becomes necessary to overhang the tool more than is desirable.

It is a peculiar and significant fact that, notwithstanding any amount of discussion, written and oral, that has taken place as to when and whether the tool point in a lathe should be on, above, or below the

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center, absolutely nothing has been done to bring it where it belongs; and the setting of the tool is left entirely to the lathe hand. Though it is generally acknowledged that the rake and clearance angles are of the greatest importance, and though up-to-date shops show their recognition of this fact by grinding the tools on special machines which will accurately produce the desired angles, yet absolutely nothing is done to set the tool in the machine in such a way that these angles are really used while cutting.

It is not in the scope of this series of articles to show the almost unlimited number of devices and constructions which could be used to produce the proper results with the almost unlimited variety of tools and conditions under which they have to work. There is no doubt but that almost any designer could produce the proper holding means for a given tool working under given conditions. What the writer wants to point out is that tool and toolholder should be considered together, and that an attempt to make a single toolholder do for all conditions that may come up must necessarily produce but a poor makeshift.

In the present day, a great many machines are being built for special purposes and in such machines we find as a rule, that the requirements of the toolholder have been well studied and the proper construction thought out, but we do not find this condition in the standard machine tools.

Inadequate Average Toolholder Design

Though, in the majority of cases, special purpose machines are provided with toolholders which hold the tool rigidly and with short overhang, most of them do not have the means for fine adjustment or for restoring the tool to its original position. As a rule, the method of trial and error is resorted to, and most adjustments are made with the tool slide or carriage or whatever the name of the supporting member may be. However, this is not always a good way of adjusting, and particularly not, when more than one tool is held on one slide. In such cases each tool should have its own micrometer adjustment and the tool should be provided with at least two ground sides bearing against hardened steel plates in order to be sure that no transverse error creeps in when a longitudinal adjustment has been made, or vice versa. It stands to reason that gages must be provided either with the machine itself or with the tooling of it to test such adjustment. After sharpening a tool, we may be sure of the angle but we cannot be absolutely sure of the amount which has been ground off and the effect this will have on the final setting.

We find spindles in most kinds of machine tools. Planers, shapers, slotters, and broaching machines are practically the only exceptions.

It is not possible to say how a spindle should be constructed unless we know the nature of the work it has to perform. Requirements of a milling machine spindle or a drilling machine spindle are materially different. The spindle of a tool room lathe must be straight, in proper alignment, and must fit its bearings closely. There is very little danger that bending of the spindle will take place under the cuts ordinarily taken on such a lathe. On the other hand, the spindle of a heavy forge lathe must be extremely heavy so as to avoid bending under the heavy cuts taken on such a machine. Where the machine is used for roughing only, a slight amount of looseness in the bearings or even a small amount of misalignment does not cause serious trouble, but its lack of rigidity would. A drilling machine spindle, if used for drilling only, can be quite loose in its bearings and does not require either extreme rigidity or extreme accuracy of alignment, whereas a milling machine spindle should be accurately aligned, should be capable of resisting bending, and should have a close fit in its bearing. In addition to all these requirements, the spindles of a multiple-spindle screw machine or chucking machine should be in close parallelism and must be very evenly spaced.

We see, then, that it is not possible to say in one sentence how a spindle should be made, but that it is necessary to analyze the conditions under which it is to work.

The nature of advertisements is a fairly good indication of what the public takes to be desirable features. The points most strongly advertised about spindles are the following:

1. Great length of spindle.
2. Large diameter of bearings, particularly the front bearing.
3. The material of which the spindle is made.

It may be well to investigate in how far these points are desirable.

A great length of spindle has this advantage: That any unavoidable looseness existing between the spindle and its bearings has a minimum effect on its alignment and consequently on the accuracy of the work. On the other hand, a great length has also the effect of permitting the spindle to bend under strain, and particularly so, if a driving gear should happen to be mounted midway between the bearings. However, whether there is such a driving gear or not, the pressure of the tool on the work, or the weight of the work itself will always have a tendency to bend the spindle. The amount of bending is directly proportionl to the length of the spindle. Here, again, we are confronted with two opposing requirements: the spindle should be made long to minimize the effect of looseness, and at the same time correct design dictates that it should be made short to minimize the effect of bending.

It is possible, of course, to minimize the effect of bending by increasing the diameter of the spindle so that a long and heavy spindle would bend no more than a short and light one, while, at the same time, the great length of the spindle would make the initial alignments somewhat better.

Proportioning Spindle Bearings Front and Rear

As to the diameter of bearing, this has its effect on the pressure per sq.in. and on the ease of lubrication. If we take as example a heavy forge lathe in which a piece weighing 50 tons is placed between centers, we find that at least 25 tons of this weight comes on the front bearing. In addition, the weight of the spindle itself, face plate, and whatever gears there may be located on the spindle, will also come on this bearing. The fact that the entire load overhangs the front bearing will cause the spindle to tip downward at the front and upward at the rear. The amount of distance between the face plate (or the center) and the front of the front bearing in combination with the length of the spindle determines how much pressure will be brought to bear on the rear bearings, but it may be said that in all cases this pressure will be only a fraction of the pressure on the front bearing. In the example chosen, this latter pressure will be considerably more than 25 tons, probably 30 tons or 60,000 lb. Select-

ing conservative conditions for lubrication and permitting a pressure of 200 lb. per sq.in. of projected area, this front bearing would have to have an area of 300 sq.in., calling for a spindle say 15 in. in diameter and 20 in. in the length of bearing. One revolution of this spindle causes the front bearing to travel almost 4 ft., so that if such a lathe should turn at the rate of 200 r.p.m., the spindle bearing would have a speed of 800 ft. per min., and the amount of work done to overcome friction would be very large unless the means for lubricating this bearing were well worked out.

We see, then, that to increase the diameter of the front bearing facilitates proper lubrication and minimizes wear for heavy loads and low speeds, but that it increases wear at high speed.

To say that a front bearing of a lathe is very large is not necessarily good advertising. A machine which must run at high speed should have as small a bearing as is consistent with proper rigidity of the spindle and with a small unit pressure on the bearing. Machines which must run sometimes at high speed with light load and sometimes at low speed under heavy load, present to the designer one of the problems which are hard to solve with any degree of certainty. If his judgment turns toward the smallest permissible diameter he may find that the machines go into a shop where practically all of the work is heavy. If his judgment turns toward the highest permissible diameter it may well be that one of these machines gets into a shop where much the greater part of the work is of a light nature, running at a high speed, and where, as a consequence, the bearings heat up.

Such contradictory requirements are found in a good many classes of machine tools. A drill press may have to tap a 3-in. hole one day and drill ¼-in. holes the next. A milling machine may have to work with an 18-in. cutter one day and with a ¼-in. cutter the next. A lathe may be used one day to turn up a heavy steel casting and the next day to drill a deep hole in a piece of brass.

Calculator for Horsepower of Spur Gearing—Discussion

By Horace W. Leet
Assistant Professor, Machine Design, University of Rochester

In going over the article on calculating horsepower of spur gearing by Robert Johnson on page 13, Vol. 62, of the *American Machinist*, I was impressed by the fact that Mr. Johnson used the Lewis formula to correct for the allowable stress in the teeth, but not the Lewis formula to determine the strength of the teeth.

I believe the formula, $W = p \times b \times s \times y$, is acceptable for this calculation, and have checked the particular example used by Mr. Johnson.

The general equation is hp. $= \frac{WV}{33{,}000}$ or hp. $= \frac{W\pi DN}{33{,}000 \times 12}$

where W = allowable load on tooth
D = diameter in inches
N = r.p.m.

Substituting for the allowable load

$$\text{hp.} = \frac{p \times b \times s \times y \times \pi DN}{33{,}000 \times 12} = \frac{p \times b \times s \times yDN}{126{,}200}$$

where

p = allowable unit stress
b = width of face, or length of tooth
s = circular pitch
y = Lewis factor $= 0.124 - \frac{0.684}{n}$ (for 15 deg. involute system)
n = number of teeth on gear.

This brings me to a correction in finding the allowable stress. Instead of a factor of $\frac{600}{600V}$ as given in the article mentioned, p has a factor of $\frac{600}{600 + V}$

For the particular example

$$\text{hp.} = \frac{7{,}750 \times 10 \times 3 \times 0.088 \times 18\frac{1}{8} \times 200}{126{,}200} = 585$$

$$p = 20{,}000 \left(\frac{600}{600 + 950}\right) = 7{,}750 \text{ lb. per sq.in.}$$

This is assuming the load carried by one tooth only (the safe way) but in many cases the hp. may be multiplied by 1½, on the basis that two teeth carry the load if the gears are cut accurately.

I was much interested in the calculator. It is a clever device and serves as a check on gear hp., but does not, I believe, give due credit to the gear in regard to the load it may carry.

If any of my interpretations are wrong, I would be glad to see the light.

Famous Machinists of History

By H. H. Manchester

Sir Daniel Gooch (1816-1889)

Sir Daniel Gooch was born in 1816, at Bedlington, England. As a child he showed strong mechanical tastes and abilities in Birkenshaw's iron works, in Bedlington, and at fifteen went to work in the Tredegar iron works, at Monmouthshire.

Three years later he went to Warrington, and found work in the locomotive shops of Robert Stephenson, spending three years with the Stephensons there and elsewhere.

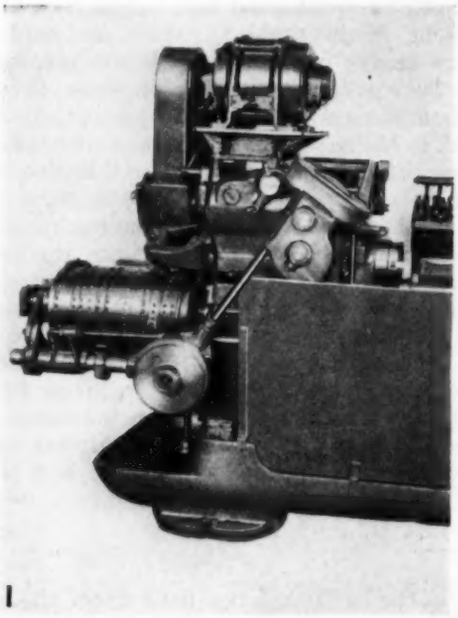
The Great Western Railway in 1837 was looking for a superintendent for its locomotive plant who could improve the quality of its engines. Gooch was recommended for the place, and at once began to make noteworthy improvements.

At the exposition in 1851, his locomotive "Lord of the North," took the gold medal, and was considered the highest type of English locomotive at the time.

In 1864 Gooch left the Great Western Railway, and became interested in the Ocean Telegraph. He was one of the bond-holders of the Great Eastern, and believing that that ship was best able to lay the cable, got her chartered for that purpose in 1865. He directed the laying of the cable that year, but it broke in mid-ocean. The next year he superintended the laying of the new one, and the picking up and splicing of the ends of the old one, thus completing two lines.

That same year he was made chairman of the board of the Great Western Railway, and during the rest of his life did much to develop the railway systems of England.

He died at his residence near Windsor, in 1889.



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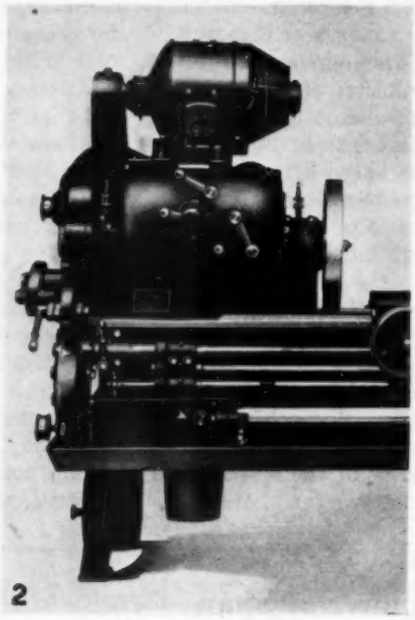

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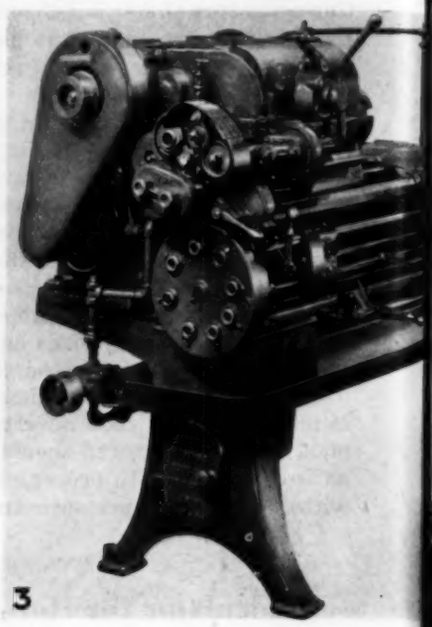

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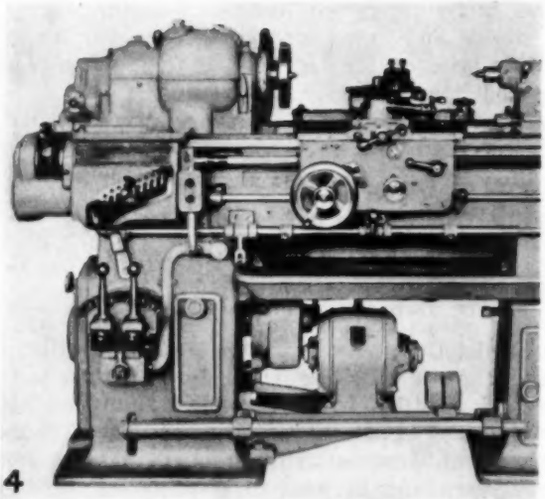


4

Modern Methods of

Lathes

Fig. 1—Fay Automatic

Fig. 2—Springfield Machine Tool Co.

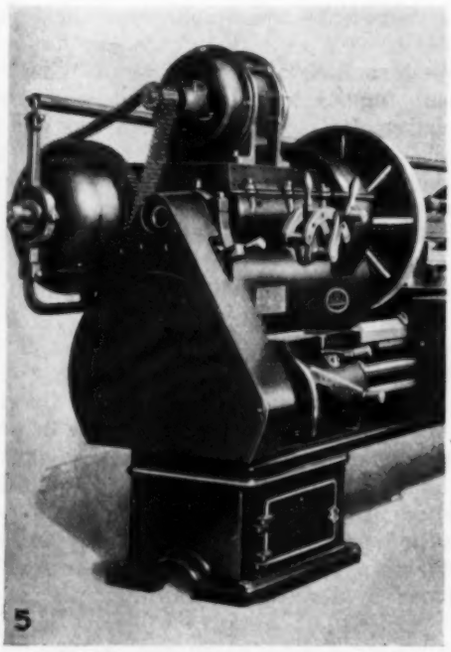
Fig. 3—Springfield Machine Tool Co.—motor mounted behind and below head

Fig. 4—Hendey Machine Co.—motor under bed, foot brake bar in front

Fig. 5—Monarch Machine Tool Co.—chain guard removed

Fig. 6—Pratt & Whitney—motor in base

Fig. 7—Bradford Machine Tool Co.—motor in rear, geared to gear box



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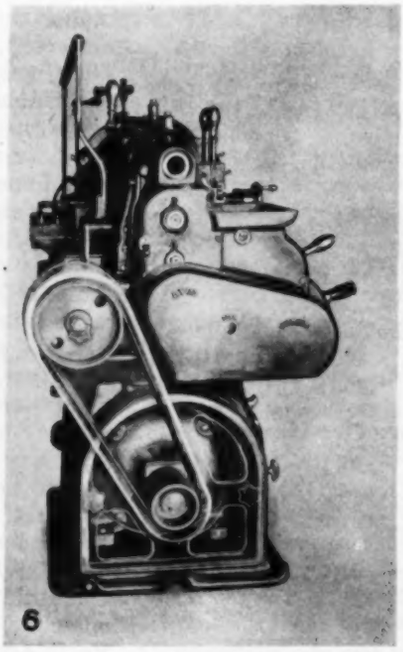

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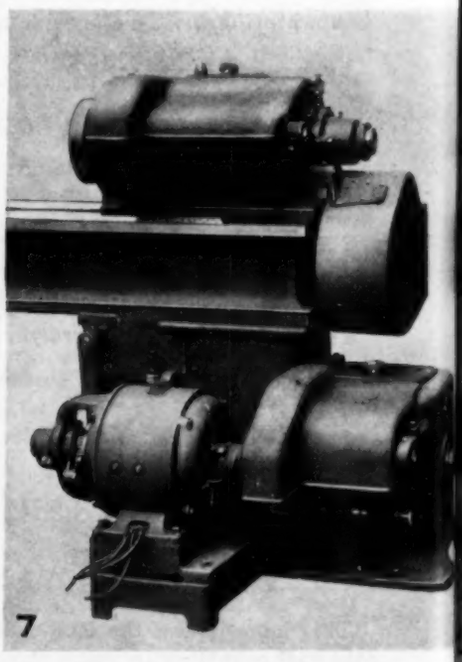

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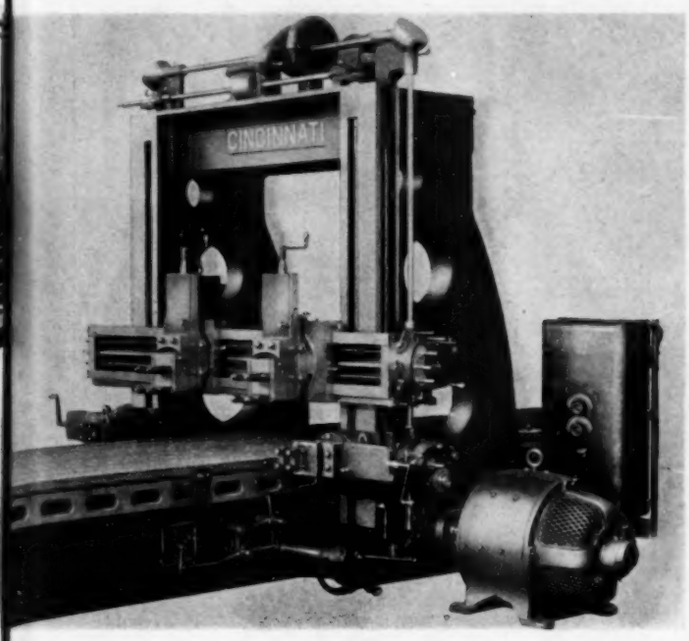
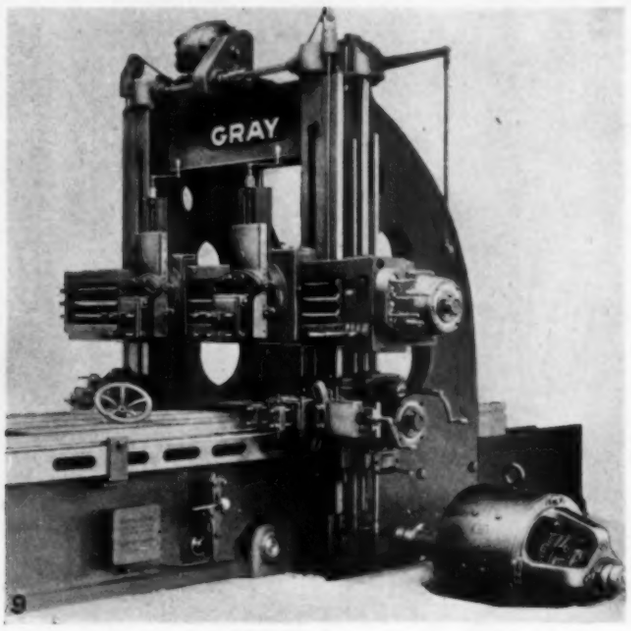




Mounting Motors

Planers

Fig. 8—Gray—two motors, flexible coupling

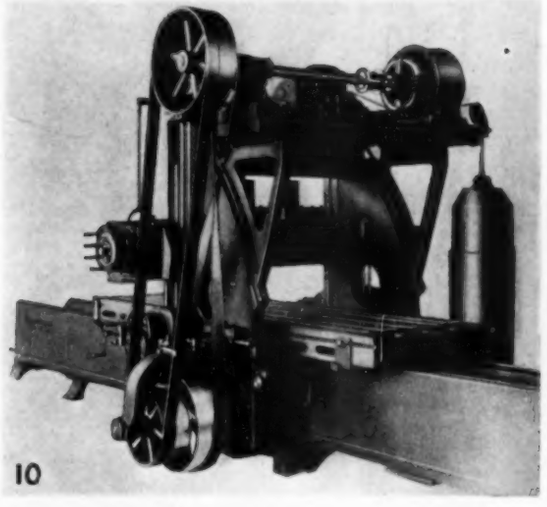
Fig. 9—Cincinnati—two motors, flexible coupling

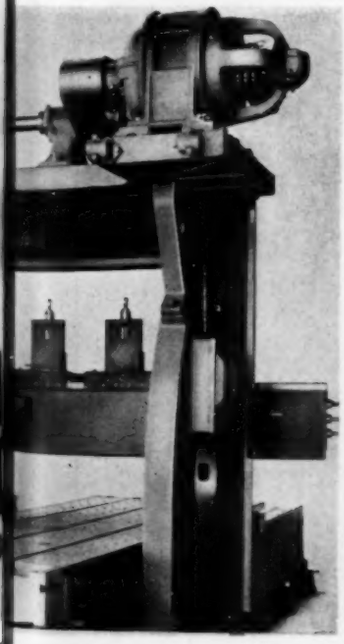
Fig. 10—Gray—two motors, both on top of planer

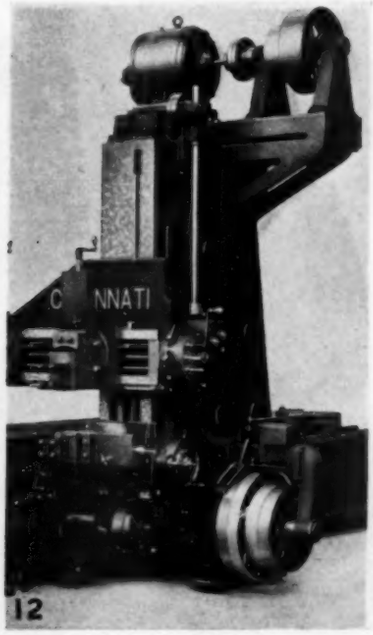
Fig. 11—Gray—one motor, belted to drive shaft on top

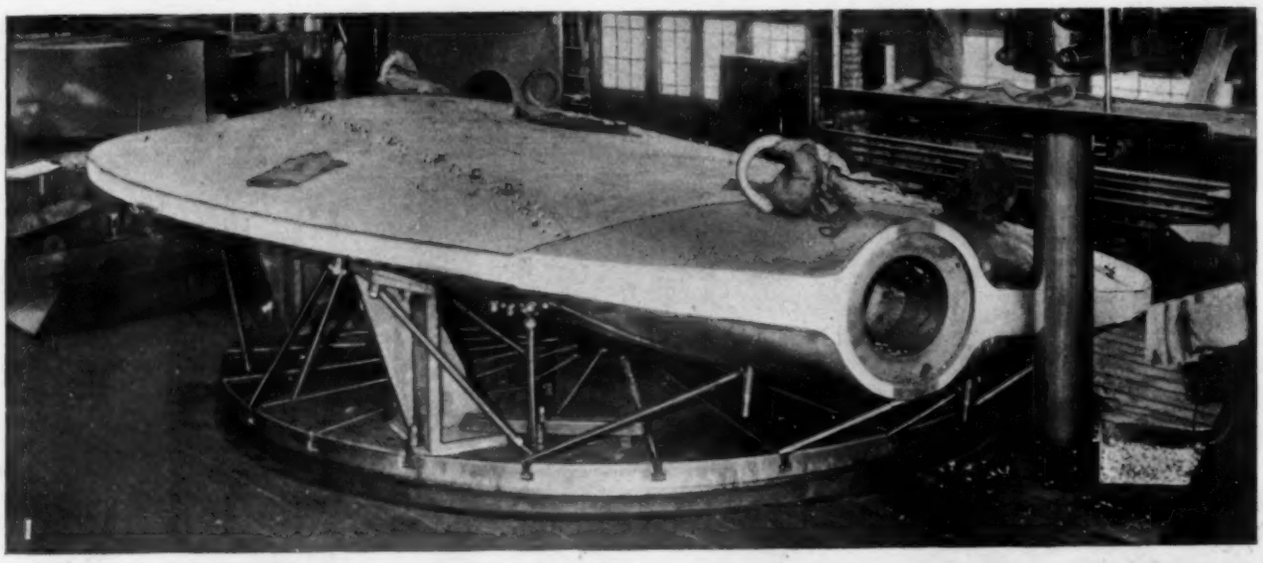
Fig. 12—Cincinnati—open side, motor on top of housing, flexible coupling

Fig. 13—Cincinnati—open side, two motors









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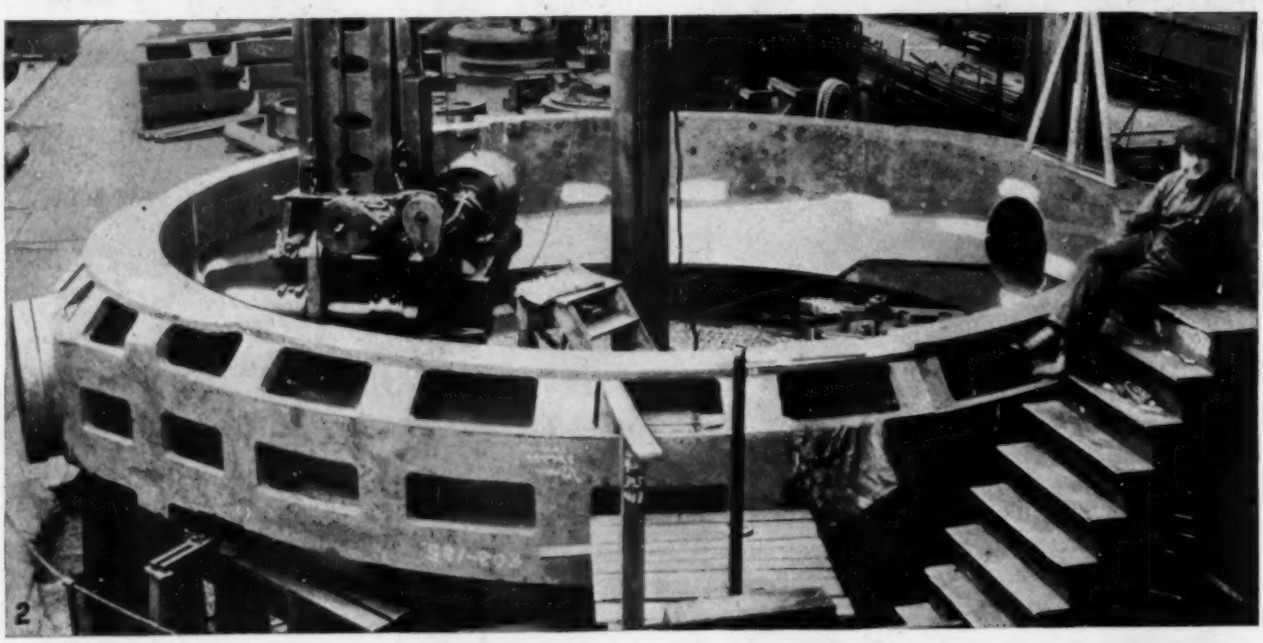

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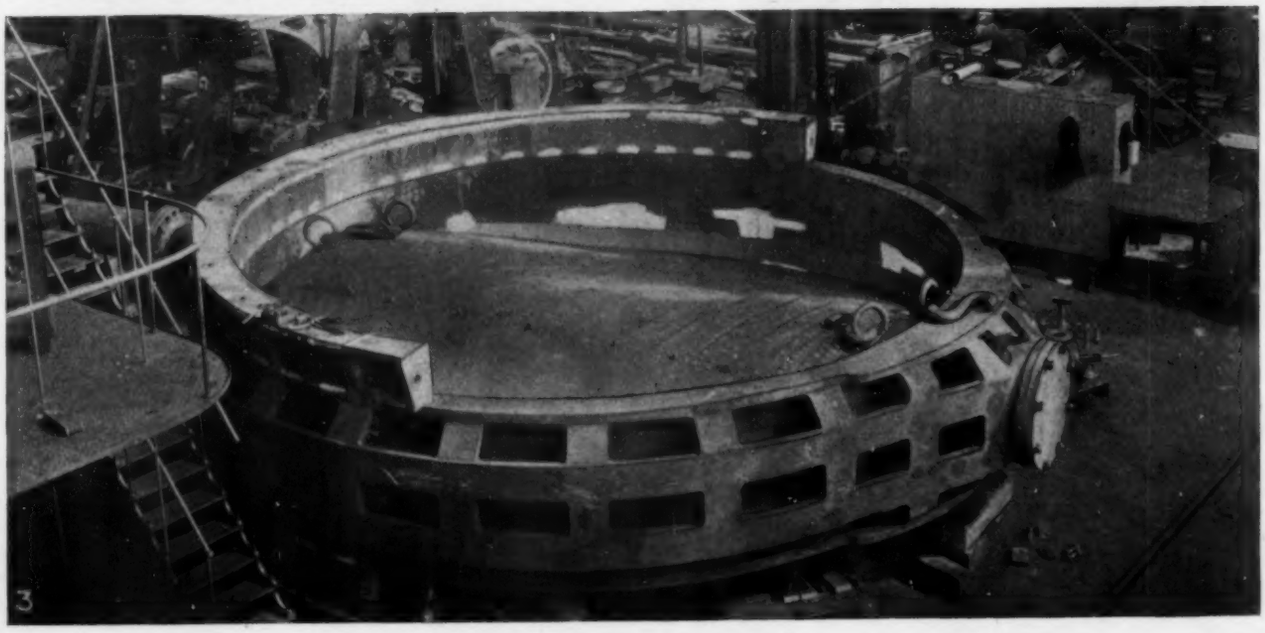

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A 98-Ton Butterfly Valve

Part of the equipment recently built by the Allis-Chalmers Manufacturing Co., for the Niagara Falls Power Co., was a huge butterfly valve that weighed 98 tons and had a diameter of 23½ ft. The valve, or wicket, must stand a working pressure from a 50-ft. head of water. And while this is but 22.2 lb. per sq.in. there are 62,458 sq.in., making a total pressure of 1,386,567.6 lb. on the wicket.

Such a pressure, it is estimated, will deflect the wicket about ½ in. So, in order to have the wicket tight in its seat, it is deflected during the machining operation to approximately the shape it will assume when under load. Fig. 1 shows the wicket mounted on a boring mill table, supported at the angle it will assume in the housing. It is built up of steel castings and boiler plate and, before machining, is deflected the desired amount.

The machining of the seat is shown in Fig. 2. The housing is supported over a floor boring machine in which the tool travels around inside the work, which is stationary. This view shows that the seat in the housing is at about the same angle as that of the wicket while Fig. 3 shows the wicket in place and seated in the housing.

A better idea of the size of the housing may be obtained from Fig. 4, where its diameter of 23½ ft. shows up to advantage.

Another and even more striking idea of its size may be had from Fig. 5, where the wicket itself is suspended from a crane. The men in the picture make an excellent comparison. This view also shows the boiler-plate sides. The steel castings show at the top and bottom and, of course, also extend around the edge to make the seat.

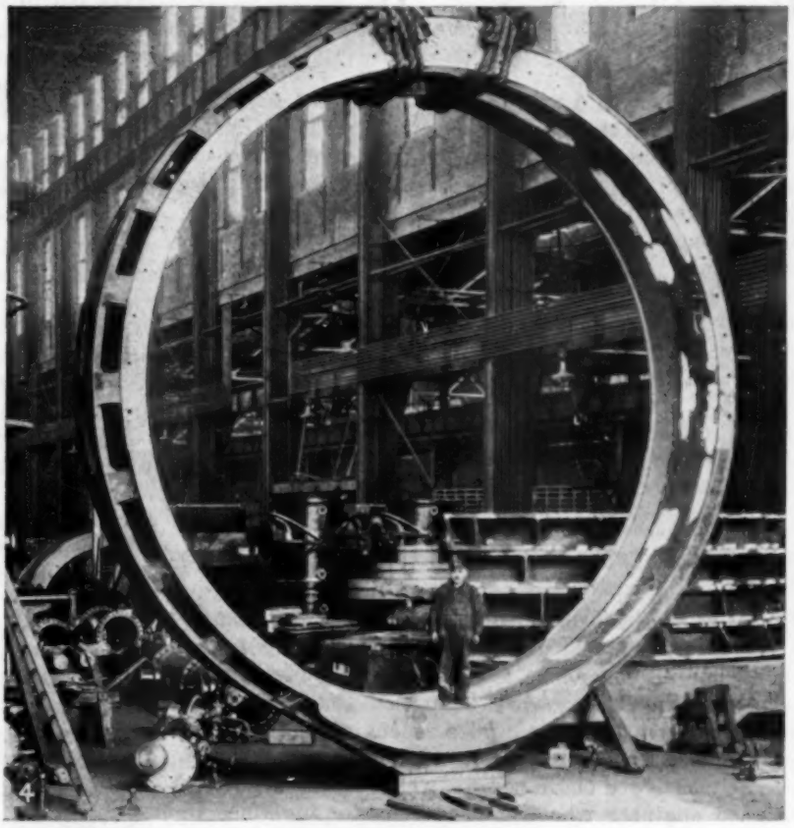
Fig. 1—Turning the 23½ ft. wicket

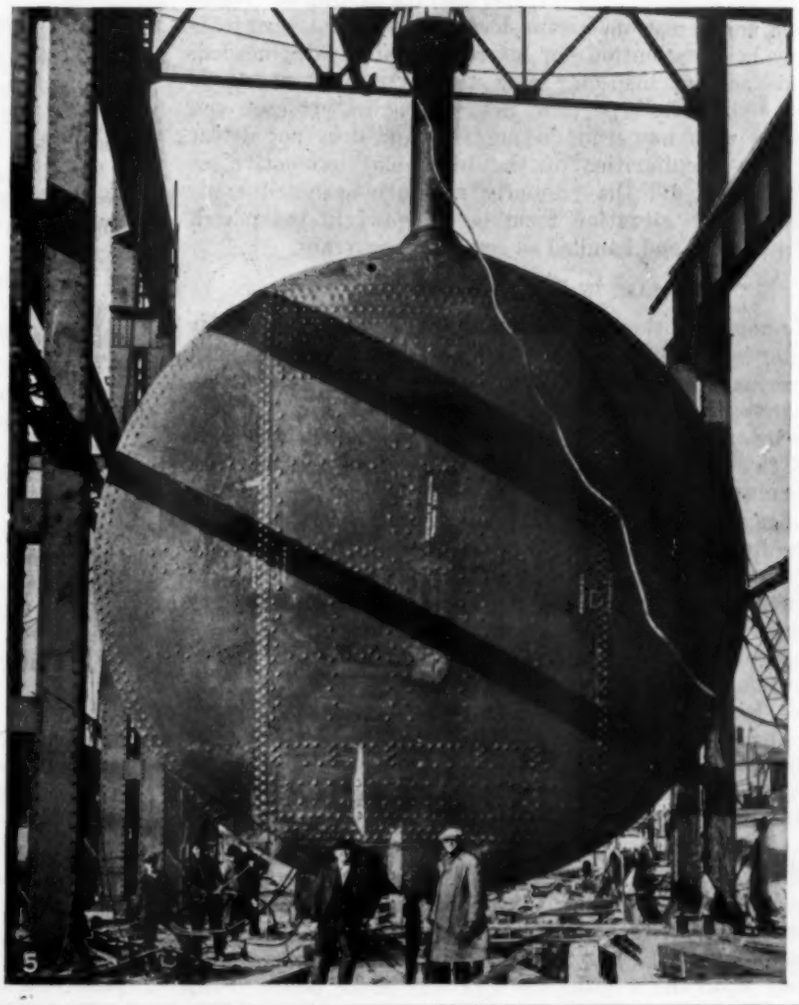
Fig. 2—Boring the seat in housing

Fig. 3—The wicket in plate in housing

Fig. 4—Housing ready for assembly

Fig. 5—The complete wicket





Back Shop Notes—Discussion

By F. M. A'Hearn

By an odd coincidence, the statement that fifty per cent of each new tire becomes scrap was made by Frank C. Hudson in an article under the title given above on page 909, Vol. 61, of tne *American Machinist*, and also by the writer on page 933 of the same issue. It is well known among men responsible for locomotive maintenance, that tires below certain limits of thickness cannot be continued in service on account of the tendency too break or to loosen on the wheel centers. Regardless of personal opinions in the matter, the Interstate Commerce Commission, through the Bureau of Locomotive Inspection, has established certain condemning limits. These limits, based on expert observations of the locomotives under the jurisdiction of the Interstate Commerce Commission, are as low as safe operation will permit.

Modern Conditions Responsible for Excessive Wear

Modern operation conditions are such as to offer many chances to overlook the importance of constant vigilance in the matter of tire wear. In fact, cases are found where modern conditions are responsible for excessive wear. The modern system of pooled locomotives, or better known in railway circles as chain-gang service, has removed one protection available in the days of regularly assigned engine crews. That is, the regularly assigned engineer who exercised constant vigilance to keep his locomotive in the best possible condition. While each engineman delivering locomotives at the terminals may be conscientious in his reports of repairs needed, and each pit inspector may use his utmost efforts to make complete reports of needed repairs, yet each one works with numerous locomotives and does not detect certain peculiarities of the individual locomotive as readily as did the formerly regularly-assigned engineer. This situation must be accepted in the march of progress and handled as conditions warrant.

Decrease in Time for Turning Tires

Shop conditions are such as to cause disregard for what were at one time formidable tasks. It has been demonstrated that it is now possible to un-wheel a locomotive, turn tires, and again wheel the engine in almost as brief a time as was once needed to turn a single pair of tires. It is possible that the ease with which tire turning may be accomplished, leads to disregard of tire mileage and the attendant vigilance necessary to detect the first indications of unusual or rapid wear.

Frame welding without subsequent checking of the wheel base, as sometimes practiced, is a contributory cause of excessive flange wear. Instances are found where a slight variation in the length of the welded section creates an error in the wheel base that may not be detected until excessive flange wear is noticed on one side of the engine. Even then the real cause of the wear may escape detection. Where a number of locomotives of similar type are in the same service, there should be no great variation in the mileage between tire turnings of the entire lot of engines. If, however, a certain locomotive develops rapid flange wear on one side subsequent to frame welding, the wheel base must be corrected if an average tire mileage is to be obtained. Flange wear has a direct bearing not only upon the mileage the tire may make before being taken out of service for a thin or for a vertical flange, but also upon the amount of tread metal that must be removed to restore the proper contour of flange and tread. In considering the heavy expense involved in renewing tires, for material and labor alone, it can readily be seen that by extending the service life of tires even five or ten per cent, a very substantial sum can be realized on a road with a few hundred locomotives. If the material and labor incidental to tire renewals or tire turnings were the only item of expense involved, it might be shown that extreme efforts to gain high tire-mileages are unjustified. The greater expense is caused by the fact that tire wear at certain limits, constitutes a condition necessitating immediate withdrawal of the locomotive from service until repairs or renewals are made. It is customary at such repair periods to repair or renew other parts not necessarily worn ont, but in the interests of economy must profitably renewed while the locomotive is withdrawn from service for tire work. Summing up then, we find that while one locomotive may be successfully operated for twelve months and finally shopped for tire wear, a similar locomotive may only make nine months under the same service conditions, but will receive practically the same repairs with only 75 per cent of the service rendered in the first case. The necessity for conservation of the service metal of the tire is obvious. It will also be seen that careful observance of tire wear may add several thousand miles to the service of the locomotive between shoppings and incidentally save considerable expense in repairs.

Worn Tires Must Be Re-Turned

Once tires are worn, there is no safe way of restoring the contour, except by turning. Since gas and electric welding have been introduced into railway shops, building up of worn flanges or of flat spots has been tried, but is not considered good practice. The subject has been carefully investigated. The results of the investigation have developed the information that fractures have resulted subsequent to building up tires by welding. While annealing has been suggested, it is difficult to see where annealing will unite the fine fractures commencing at the point where the intense heat necessary to welding is applied.

The fact that cases are knnown where welded tires have been successfully operated, does not justify a practice that involves the hazards attendant to the possible breakage of a tire in service. Tire welding should not be practiced until it has been proved that the finished product comes within the general requirements of locomotive operation. That is, that the locomotive is in safe and suitable condition for service.

Thermal Expansion of Nickel Chromium Steels

An investigation on the thermal expansion of nickel-chromium steels has recently been started in order to obtain data on a series of commercial types of nickel-chromium steels, in both the normal and the quenched conditions, according to Technological Bulletin No. 94 of the Bureau of Standards. The coefficients of expansion of these steels are to be determined for various temperature ranges between room temperature and 600 deg. C. This research was undertaken at the request of a large steel company.

Metallography of Non-Ferrous Metals

By Joseph Kaye Wood
Consulting Engineer, New York City

Heat-treatment of non-ferrous metals—Constitutional diagrams of zinc-copper and copper-aluminum alloys—The characteristics of duralumin in the copper-aluminum group—Lists of the leading alloys

ALTHOUGH some of the non-ferrous metals, such as those of the copper-zinc series of alloys, have been used quite extensively in the various mechanical industries, they have not been so well understood from a metallographic standpoint as iron or steel. Aside from the fact that the latter two metals are cheaper and in greater use, it is not so apparent why the aforesaid general lack of knowledge in non-ferrous metallography should exist. Able investigators and writers have covered this field very exhaustively and quite a few manufacturers have taken advantage of the information so disseminated. Yet in spite of this fact there is reason to believe that the fundamental principles in the metallography of non-ferrous metals are not generally known. Perhaps it is because these metals lack the necessary properties and allotropic characteristics to give them the same technical importance as iron and steel. Thus we do not speak of hardening and tempering brass by the processes of quenching and drawing as in steel, but we can produce these affects by the process of alternate rolling and annealing or even by quenching.

From a metallographic standpoint, brasses for industrial purposes are quite limited. To make this clear we refer to the constitutional diagram for the copper-zinc alloys, shown in Fig. 1. A rigorous understanding of the diagram is not essential for practical purposes, except to say that each area represents a definite phase or allotropic form of the alloy. These phases are labeled with Greek letters, probably for no other reason than the lack of persons names whose prominence could be identified with the development of the brasses as clearly as in the development of the steels.

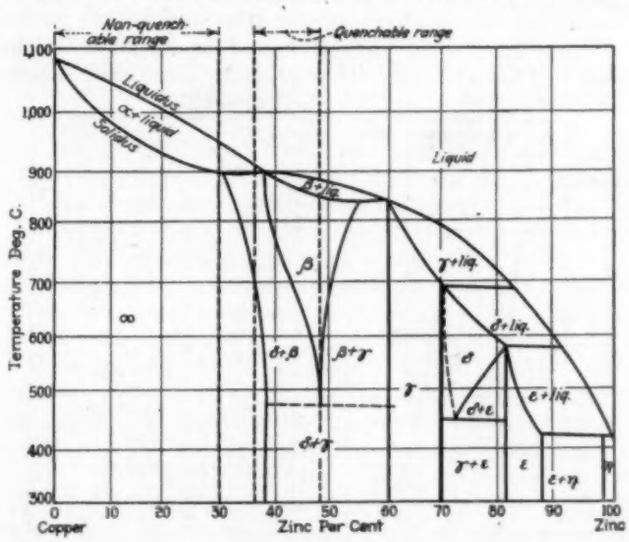


Fig. 1—The zinc-copper constitutional diagram—after Rosenhain

The gamma or γ phase of brass is very brittle and much weaker than the beta or β phase. The β phase is harder and stronger, but also much more brittle than the alpha or α phase. For industrial purposes the composition of the copper-zinc series of alloys is limited to 50 per cent zinc, for beyond this point the objectionably weak γ structure is produced. Brasses having between 37 and 47 per cent zinc may be heat-treated to advantage because then either all β or $\beta + \alpha$ may be produced instead of the objectionable $\gamma + \alpha$ structure. Below 37 per cent zinc only soft α brass is produced which is somewhat similar to pure copper. In the "as cast" condition the roughly polygonal crystalline structure also resembles that of copper. Beyond the 37 per cent point, or with the formation of solid solutions and excess zinc, dendritic formations tend to mask the polygonal structure.

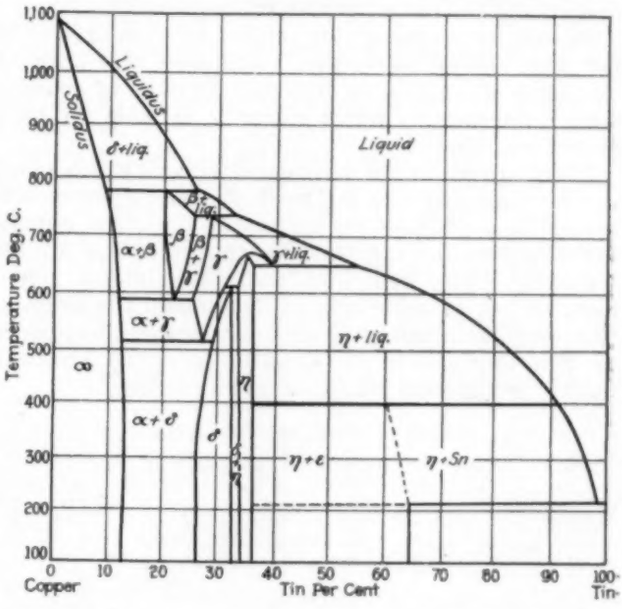


Fig. 2—The tin-copper constitutional diagram—after Rosenhain

Annealing to a temperature corresponding to the zinc content will eliminate dentrites in 37 per cent and higher brasses, resulting in a homogeneous structure. If the annealing is accomplied by mechanical work such as rolling or drawing, "twinned" crystals will result.

The constitutional diagram is marked with broken vertical lines in Fig. 1 to show the types of brasses as regards composition and micro-structure that are used for various purposes. These types may be further modified for other purposes by the addition of a third element such as lead, aluminum, manganese, tin, etc.

Brass that is free cutting and hence suitable for machining generally contains from 34 to 38 per cent of zinc along with 1 to 3 per cent of lead. The latter element aids in the free cutting qualities by decreasing the size of the grain and by a lubricating action. Reference to the diagram in Fig. 1 will show that for the lower zinc contents of this range the micro-structure may be an aggregate of $\alpha + \beta$, which permits easy machining while after machining, if heat treated, the structure may be made up entirely of α crystals resulting in greater ductility and toughness. On account of the brittleness of these brasses, particularly for the higher zinc contents, they are not suitable for cold working such as bending, forming or drawing.

By reducing the zinc range to between 33 and 36 per cent and also by reducing the lead content a series of brasses can be produced which are not so free cutting but which can be bent, formed or otherwise cold worked. A further reduction of the zinc content to between 14 and 17 per cent decreases the difficulty of cold working, and greatly increases the free cutting quality.

Brazing brass has a zinc content between 22 and 26 per cent. Reference to Fig. 1 will show that brass of this composition has the high melting point of approximately 900 deg. C. which makes it suitable for hard solder brazing.

There are about 275 commercial brasses which range in zinc content from a minimum of about 5 per cent to a maximum of about 50 per cent. The other constituents beside zinc may be any one or several of the following: Tin, lead, iron, manganese, nickel, aluminum, silicon, tungsten and phosphorous. The compositions of some of the more important brasses, mentioned by Wm. Campbell in the *Proceedings* of the American Society for Testing Materials, are as follows:

Commerical Name	Copper	Zinc	Special
Common brass	65	35	.....
Drill rod	62	35.5	Lead 4.5
Forgings	60	40	.....
Commercial brass	63	37	.....
Low brass	80	20	.....
Naval brass	61	38	Tin 1
Wheel brass	68	30	Lead 2
Screw brass	78	16	Tin 4.5; lead 1.5
Screw wire	62	38	.....
Spring brass	72	28	.....
Washing brass	62	38	.....
Wire, common	65.4	34.6	.....
Nickel brass	54.1	43.6	Nickel 1.5; iron 0.5
Manganese brass	80	5	Manganese 15
Brazing brass	75	25	.....
Binding brass	63.25	35.0	Lead 1.75
Clock brass	62.5	35.75	Lead 1.75
Eyelet brass	65	35	.....
Mu-Ni brass	65	5	Manganese 20; nickel 10
Commercial bronze	90	10	.....
Rich-low brass	85	15	.....
Tungsten	59.73	33.97	Tin 0.15; tungsten 2; Aluminum 2.8; manganese 0.7
Vanadium brass	70	29.5	Vanadium 0.5

The composition of some of the above brasses are apparently somewhat similar, but it must not be forgotten that the "temper" or hardness may be made to vary widely by varying the amount of cold work, such as rolling or drawing. Thus in most cases of sheet brass, a scleroscope hardness varying from full soft or 25 deg. to extra spring or 70 deg. may be produced.

Most of the bronzes, that is, of the copper-tin series of alloys used for industrial purposes have tin content below 12 per cent. The constitutional diagram for this system of alloys, Fig. 2, shows that for 12, or less, per cent of tin, solid solutions are formed which of course eliminate the possibility of quench hardening. α bronze is very much similar to α brass, in that it responds favorably to mechanical working and annealing. Higher tin content, however, makes cold working very difficult, due to the introduction of the other phases which are very hard and brittle. Bronzes of complex micro-structure are seldom used. A few having less than 20 per cent and more than 12 per cent of tin being used for certain purposes such as axle bearings.

As in the brasses, dentritic formations in bronzes containing less than 10 per cent are eliminated by slower freezing or annealing at high temperatures. Such annealing, however, greatly affects the physical properties.

The bronzes are of a wide variety in composition, serving a great many useful and important purposes where brass lacks sufficient strength. Important uses are for bearings, gears, marine parts, valves, etc. The most important of the special alloys are those containing phosphorous.

Some of the industrially important bronzes listed by Wm. Campbell are as follows:

Commerical Name	Copper	Tin	Zinc	Lead	Special
Gear	88	10	....	....	Phosphorus 2
Gear	85	13	2	....	.....
Gears	85	10	3	2	.....
Gun metal	90	10	....	....	.....
Hydraulic	83	10.8	6	0.1	.....
Bushings	85	11	4	....	.....
Cogs and worms	85	11	4	....	.....
High temperature	90.7	2.7	6.3	1.3	.....
Gurney's	75.8	9.2	15	....	.....
Stone's English gear	89	11	....	....	.....
Schmidt's locomotive bearing	86	14	....	....	.....
Screw-nut	86	11.4	2.3	....	.....
Sashchain	92	8	....	....	.....
Slide valve	88.5	2.5	9	....	.....
Railroad piston & rods	74.1	3.7	22.2	....	.....
Naval journal	83	13.5	3.5	....	.....
Manganese	82	8	5	5	Manganese 2
Piston	83	1	16	....	.....
Piston rings	84	2.9	8.3	4.3	.....
Phos. bronze wire	98.75	1.2	....	....	Phosphorus 0.05
Very hard phosphorus	80	9	....	....	Phosphrous 1
Phosphorus bearings	83	14	2	1	Phosphorus 1
Phosphorus bushings	79	10	....	10	Phosphorus 1
Phosphorus gears	85	13	2	....	Phosphorus 0.1
Sheet	90	10	....	....	.....
Sheet phosphorus	94	4	....	....	Phosphorus 0.1

A tentative constitutional diagram of the aluminum-copper series offered by Rosenhain and based on data supplied by Carpenter, Edwards, Curry and others is shown in Fig. 3. As in the zinc-copper and tin-copper series, there is also in this diagram a solid solution phase in the copper rich compositions. According to Rosenhain, the α phase of the aluminum-copper series is very similar in character and appearance to the pure α phase in the two previously considered copper

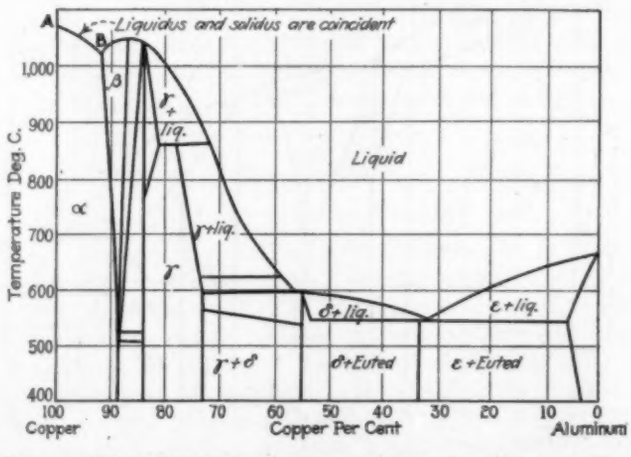


Fig. 3—The aluminum-copper constitutional diagram—after Rosenhain

series. When annealed, after cold working, it also readily undergoes twinning.

The principal difference of this series, up to 7 per cent aluminum, as compared with the other two is that the solidus and liquidus lines are practically coincident instead of being spread apart. This means that freezing of all parts is instantaneous with the result that dentritic structure is absent on rapid cooling. The physical properties of the aluminum-copper alloys, therefore, are quite different from those of either the

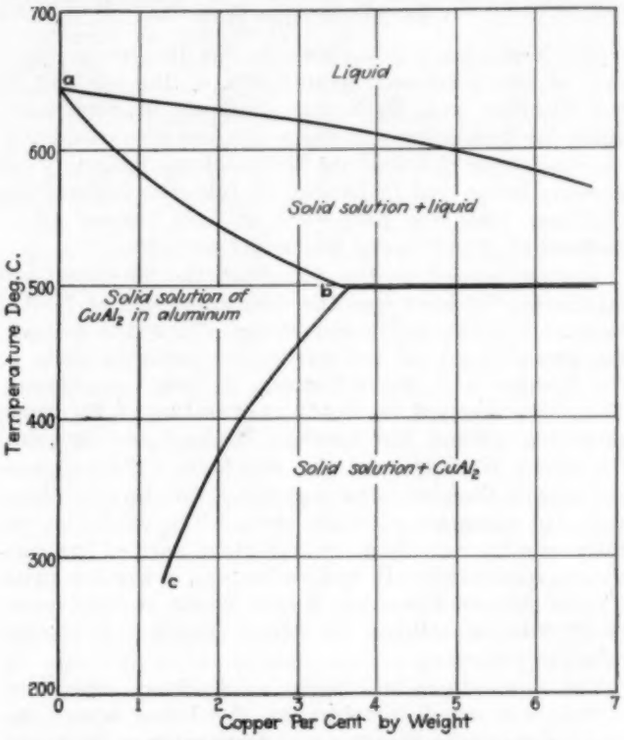


Fig. 4—The solubility curve of $CuAl_2$ in aluminum according to Merica, Waltenburg and Scott

zinc or tin-copper series of alloys. Beyond 7 per cent aluminum, the metal loses nearly all ductility and the micro-structure becomes very complex except near the extreme aluminum end of the diagram. At this end, we have another but less useful range of solid solutions. Adding about 0.65 magnesium and 0.50 manganese to the compositions at the maximum limit of this range produces the very useful and light alloy known as duralumin.

The properties of duralumin are as interesting as they are useful. The additions of the small amounts of magnesium and manganese mentioned above seem to confer upon the aluminum a rich aluminum-copper alloy, the peculiar property of hardening slowly within a few days after a prescribed method of heat treatment. This heat treatment consists in placing the duralumin parts on an iron plate and soaking them for twelve or fifteen minutes at a temperature of 930 deg. F. They are then quenched in ice water. Any cold work, such as rolling or drawing is then done, after which the parts are left to age for a few days at room temperature. This aging has the effect of improving the physical properties of duralumin and if the aging is carried on at an elevated temperature (about boiling water) the improvements are accelerated.

To those that do not take statements lightly the peculiar and contrary behavior of duralumin as regards its heat treatment, will be wondered at. In most heat treatments dealt with in ordinary production, quenching in ice water produces a very hard and sometimes brittle structure, but in the case of duralumin, the strength and hardness immediately after such quenching corresponds to the fully annealed state. Then, upon aging, the hardness and strength increase as much as 30 or 40 per cent. Well-known authorities give the following explanations of this phenomenon.

Referring to Fig. 4 which shows the right-hand or the aluminum-rich end of the aluminum-copper constitutional diagram in Fig. 3, it can be seen that the solubility curve *b-c* : of $CuAl_2$ in aluminum crosses the 500-deg. C. (930-deg. F.) line at about 3½ per cent copper and the 300-deg. C. line at about 1½ per cent copper. It is the opinion of the originators of this curve, that the line *b-c* probably crosses the room temperature line at less than 1 per cent copper. There is a probable precipitation of $CuAl_2$ particles, too small to be seen by the microscope. It is further explained that the degree of dispersion of these particles, which depend upon the quenching temperature and the aging period, largely determines the resulting physical properties. Thus it is their opinion that a dispersion intermediate between atomic and microscopic size is the one which produces the known physical properties. The mechanism whereby the proper degree of dispersion of the $CuAl_2$ particles produces the maximum hardness, is explained by Jeffries in his "Slip Interference Theory of Hardness." Thus the hardness is said to be due to improved "keying" or "interference" which well dispersed particles of relatively small size will have over poorly dispersed larger particles. This "keying" or "interference" refers to the obstruction which these particles offer to the plastic movement of the relatively soft matrix of the aluminum-copper solid solution along the easy-slip planes. In the light of future education on the subject of heat treatment, it is interesting to note the following paragraph taken from Jeffries' paper.

"The explanations of the hardening of duralumin and of hardening by grain refinement are so simple and logical that we should examine the phenomena of the hardening of steel from the same viewpoint. The fact that iron is capable of existing in at least two crystalline forms makes it difficult to differentiate between cause and effect and to appraise the true significance of the "critical" changes. The case of duralumin might be equally difficult to understand if hardening by heat-treatment were accompanied by allotropic and visible structural changes. Hardening of duralumin does not involve an allotropic change, twinning, or even a refinement of grain."

Diagram Location of Useful Compositions

It will be well to pause at this point and note some generalities in connection with the three systems of non-ferrous metals so far considered, namely the zinc-copper, the tin-copper, and the aluminum-copper series. In all cases the industrially useful compositions are confined to the extremities of the respective constitutional diagrams where, for a limited extent, solid solutions are the rule. It is a fact that the hardness and strength of a metallic element may be increased by dissolving some other metallic element in it. Furthermore, if some fine hard particles of a compound can be precipitated from this solution and uniformly dispersed, then further hardness and strength can be imparted to the metal. Thus the aluminum-rich end of the alumi-

num-copper series is found to yield the very useful metal, duralumin, which might be microscopically defined as a solid-solution matrix of aluminum and copper in which hard $CuAl_2$ particles (and also Mu_2Si and Mg_4Al_3) are finely dispersed.

Campbell's list of alloys include the following industrially useful metals of the aluminum-copper system with or without additional constituents.

Commercial Name	Copper	Aluminum	Special
Aluminum bronze	90	10	.....
Navy	85—87	7—9	Iron 2.5—4.5
Heusler's alloy	68	10	Manganese 18; lead 4
Cowles aluminum bronze	88.4	9.74	Iron 0.43; silicon 1.36
Cowles special A	89	11	.....
Aluminum iron bronze 8	85.15	9.43	Iron 4.74; lead 0.38; phos. 0.09
Super bronze	68.9	5.1	Iron 2; zinc 20.9; manganese 3
Typewriter metal	57	3	Zinc 20; nickel 20
Duralumin	4.2	Balance	Manganese 49; magnesium .76; Iron .67; silicon .34
Die casting	8	92	.....
Die casting	18	82	.....
Fletcher's alloy	3	95.5	Tin 1; and others
Ingots	....	....	.....
Casting 12	8	92	.....
Casting 21	10	90	.....
Rolling 5.5	2	94.5	Zinc 2; manganese 1.5
Lynite	....	....	.....
Body alloy	5	Balance	.....
Piston	11	89	Magnesium 0.5
McAdams W. A.	12	82	Cadmium 5; silver 1
Al-Cu strongest	3.75	Balance	.....
Al-Cu-Ni	2.0	Balance	Nickel 5.25
Al-Cu-Mg	4.0	95.5	Magnesium 0.5

The two remaining important alloy systems are the copper-nickel and the nickel-silver series. Some important compositions in the latter series are as follows:

Commercial Name	Copper	Nickel	Special
Locomotive tubes	97	3	.....
Cupro-nickel sheet	81—79	19—21	.....
Imperial metal	80	20	.....
Turbine material	79—81	21—19	Iron 0.75 max.
Monel metal, cast	28	68	Iron 2; silicon 1; manganese 0.25
Monel, metal, forged	28	68	Iron 2; silicon 0.1, manganese 1.5

In the former series, we have the following compositions:

Commercial Name	Copper	Zinc	Nickel	Special
Aluminum silicon	57	20	20	Aluminum 3
Aphit	70	5.5	20	Cadmium 4.5
Cupping & milling	58	21.5	20	Lead 0.5
Drawing & spinning	58.66	29.33	12	.....
German silvers:				
Best	46	34	20	.....
Common formula	55	25	20	.....
Sheffield hard alloy	45.7	20	31.3	.....
Milling	56	31	12	Lead 1
Milling	54	27.5	18	Lead 0.5
Nickel bronze	60	12	20	Tin 8
Nickel bearing	50	....	25	Tin 25
Sheet forming	72	10	18	Iron 0.4
Sheet spring	54	26	18	Iron 0.4

The latter type of alloys are somewhat similar to the zinc-copper series, in that they become brittle when hot, and hence are always rolled and drawn when cold.

Leaving Insufficient Metal for Machining

By Herbert F. Crawford

I've recently bumped into a case where trying to save the last minute on machining time, really cost quite a wad of money. It's the old, old story of not leaving enough metal for machining to allow the castings to be cleaned up. And even where they do clean up, the tools do not get a chance to get under the scale and have to be ground more frequently than necessary.

Sometimes this special idea of economy is based on the desire to save metal, but this was not true in the case in mind. It was solely to save a little machining time, and, as is usually the case where patterns are skimped too much, the saving went over on the wrong side of the ledger. For many of the castings would not clean up and had to be made over again, losing the castings as well as all the machine work done on them.

Whenever you are tempted to cut down machining allowance on castings, be dead sure it means a net saving. Don't judge by one or two castings but measure up a dozen or more. Count the cost of grinding and replacing tools, of rejected work, of wasted machine time, and most of all the delay it means in deliveries. In most cases you'll probably decide to let well enough alone, and not change the amount of metal left for machining.

The Railway Centenary in England

By Hubert Bentley

The preliminary arrangements for the commemoration of the hundredth anniversary of the opening of the Stockton and Darlington Railway in September, 1825, the first railway in the world, are now completed. In view of the fact that the International Railway Congress is being held in London in July, the celebrations will take place the first week in July instead of in September, which marks the actual anniversary.

Having regard to the fact that the Stockton and Darlington Railway was the forerunner of the North-Eastern Railway, with which it was afterwards merged, the greater part of the celebration naturally falls to the London and North-Eastern Railway to arrange. They have received the ready co-operation of the other three big groups, the London, Midland and Scottish, the Great Western, and the Southern Railways, who are lending their early railway relics for the exhibition, and also examples of their stock. The exhibition of railway relics will form an important part of the centenary celebration. It will be housed in the big paint shop at the new Faverdale Wagon Works at Darlington, which will be utilized for other functions connected with the centenary.

The celebrations will begin at Stockton, where the Mayor will unveil a tablet on the house where the first ticket on the Stockton and Darlington railway was issued. This will be followed by a luncheon of a local nature, after which one of the original passenger coaches in use on the Stockton and Darlington Railway—at present in the railway museum at York—is to be installed on a pedestal on the platform of the Stockton Railway station.

A procession of early locomotives and early examples of rolling stock, goods and mineral wagons, old chaldron wagons, and passenger coaching stock, together with the latest developments in locomotives and passenger stock, will be assembled at Stockton station. Two notable contrasts will be furnished in this procession by Locomotive No. 1 and the latest Pacific types, that have been on exhibition at Wembley. It is hoped that additional interest may be given to the procession, and an historical pageant character imparted, by passengers in costumes of the period. It is proposed to reserve Eaglescliffe station for railwaymen and their wives and families to see the pageant.

The following day, the members of the International Railway Congress will visit the exhibition, and will be entertained at luncheon at which William Whitelaw, the chairman of the London and North-Eastern Railway will preside. The exhibition will be formally opened that day, and will remain open for two weeks. The railway visitors will also have the opportunity of inspecting other places of interest.

The details are being worked out by a representative committee of London and North-Eastern officers.

Aluminum Solder—Discussion

By E. Andrews

I WAS particularly interested in an article under the title given above and published on page 838, Vol. 61, of the *American Machinist*.

For a permanent repair upon aluminum castings and articles made from sheet aluminum, the acetylene welding process is generally satisfactory, but there are many cases in which it is not permissible to heat the parts to the high temperatures required by this process, because of the attendant distortion.

During the last twenty years I have tested many aluminum solders and have made joints with them that were to all appearances quite satisfactory. In subjecting the soldered joints to rigorous tests the metal has almost always broken at other points than the joint, and it has been difficult to get the joint itself to yield.

But when the soldered joints have been exposed in a damp situation for a few months (unless they have been protected against atmosphere or fumes by suitable paints or varnishes) the parting of the two pieces of metal at the joint has presented very little difficulty, thus proving that many of the so-called aluminum solders are not permanently satisfactory unless protected against corrosion.

Many aluminum soldered joints fail because the metals in the soldering alloys are electro-negative to aluminum, and upon contact with moisture galvanic action is set up so that the joint disintegrates by autocorrosion. Furthermore, the surface of aluminum is covered with a thin, invisible coating of aluminum oxide, which forms instantly and is very refractory at soldering temperatures. Its presence is responsible for the high resistance of aluminum to corroding agents, since, although aluminum itself is soluble in a great many chemical compounds, the oxide is insoluble in almost everything except hydro-fluoric acid.

While in general this coating is beneficial, in that it forms a perfect protection to the aluminum underneath it, it is, by reason of its efficacy in this particular, responsible for a large part of the difficulty of soldering aluminum, since naturally, no solder will alloy with the oxide.

Soldering Iron Not Used

It is a mistake to speak of soldering aluminum as an ordinary tinner means soldering—with a hot copper and a solder that will flow and follow it. The process is more like brazing, or hard soldering. When this fact is once established in the mind, there is little difficulty in having an expert mechanic master the art, provided he has the right solder and efficient soldering equipment. An atmospheric blowpipe, or blowlamp, is essential in order to obtain the best results.

With regard to the composition of aluminum solder, those that the writer has found to be most satisfactory are composed of aluminum, tin and zinc, with from 5 to 12 per cent aluminum; 8 to 15 per cent zinc, and 73 to 87 per cent tin. A typical composition is: aluminum 7 per cent, zinc 10 per cent and tin 83 per cent.

Tinning the surface of aluminum preparatory to soldering is an important operation. When soldered joints in sheet aluminum are required, the overlap should be much less than that usually allowed for brass, copper or tin plate. The reason for this is that the solder will not flow by capillary attraction into an aluminum joint, even when tinned, as it does into other sheet metal joints.

The process of tinning is accomplished by heating the surface to be joined to a temperature somewhat above the fusing point of the solder used, a satisfactory tinned surface being obtained by rubbing with the point of a tinned-steel tool so as to remove the oxide film and allow the solder to act upon the clean surface.

After the surfaces to be united have been thus tinned they may be soldered together by pressing the tinned surfaces into contact, again heating the metal and solder to the required temperature, and finally by rubbing thoroughly the surfaces carrying the liquid solder with a hot soldering tool.

In conclusion, it should be mentioned that some recent patent aluminum solders comprise twin solders: for example, No. 1, tinning solder and soldering alloy; No. 2, finishing solder. The No. 1 is a solder with a high mechanical strength to form the joint, while the No. 2 has a lower melting point and is so constituted that, while it alloys freely with the No. 1, it has a high electro-chemical and chemical resistance to the effect of moisture.

Facts About Honing Cylinders

Honing of cylinder bores seems to be accepted as a desirable finish for good service. One well known motor builder uses No. 60 G-6 carborundum blocks, backed by flat springs. They are driven through a flexible joint, rotated 11 r.p.m. and work back and forth through the bore at 122 strokes per min. It has been found best to have the hones extend an equal distance through the bore at each end of the stroke.

The hones are flooded with a mixture of kerosene and paraffine oil, in the ratio of 15 to 1. The paraffine is added solely because it is easier on the hands of the operator. A powerful magnet is placed at the end of the return pipe to the oil tank to catch the steel particles cut away by the hones.

Hones are sometimes glazed very quickly but the glaze is readily removed by carefully rubbing a piece of abrasive wheel or block on the surface. Removing the glaze makes it possible to hone from 200 to 250 holes before truing the hones with the diamond.

When truing becomes necessary, the hone blocks are locked in position on the heads and soaked in kerosene for several hours. They are then put in a lathe and trued with a diamond. After soaking in kerosene they cut very readily and wear the diamond very little.

As evidence that there are high spots left by the grinding wheel that are removed by the hones, the effect on the size of the bore is cited by honing advocates. The hones will remove 0.001 in. from the bore of an average cylinder in about 1 min. But the next minute or two they will remove very little. The mathematical shark might say the increase in the amount removed is inversely as the square of the time. In other words, doubling the time after the first minute, results in very little metal being removed. The practice is to run the hones two minutes by a stop watch and the results are said to be remarkably uniform.

The allowance for grinding is from 0.006 to 0.007 in. If the cylinders are reamed, it is customary to allow from 0.012 to 0.015 in. for the reamer to bite into, rather than attempt to scrape out half this amount.

We are indebted to the Chandler Motor Car Co. for the data given.

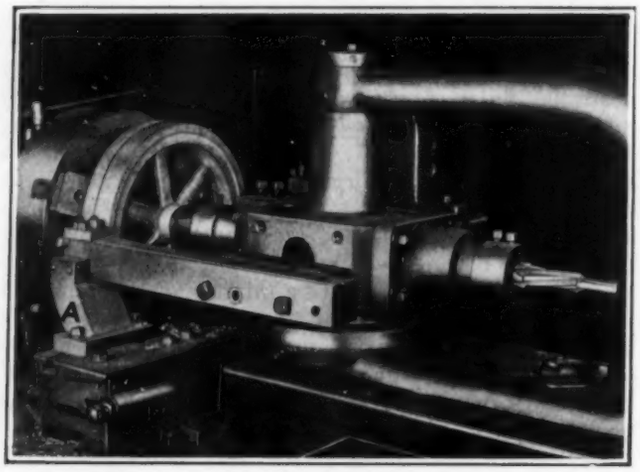
Ideas from Practical Men

The department, "Ideas from Practical Men" is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Rigid Turning-Tool for the Potter & Johnston Automatic

BY A. W. FREEMAN

To lessen the strain on the turret of the machine and eliminate as far as possible the chatter of the tools while turning gas engine flywheels, we designed a special turning bar having a guide on the cross slide. The



A rigid turning-tool

accompanying illustration shows the arrangement by the use of which we were enabled to turn out better work and increase the output.

Where it was formerly necessary to take two cuts on the outside diameter of the wheel, we now finish in one cut, the guide *A* holding the bar rigidly. The cross-slide to which the guide is bolted is so timed that it has a tendency to force the bar inward slightly, and at the end of the cut the guide backs off before the turrett recedes, thus eliminating any drag of the tool on the finished surface.

The blocks and bar were hardened, making a smooth bearing that required no oil to accumulate dirt.

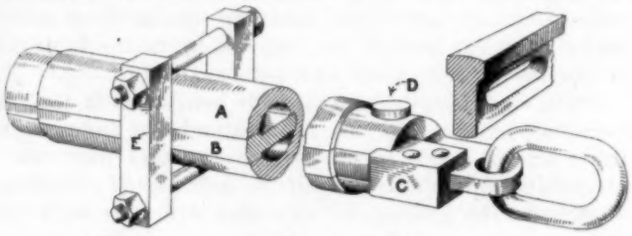
A Collapsible Mandrel for Babbitt Bearings

BY JOHN MARCH

To pour babbitt bearings in halves to finished sizes is a comparatively easy task, but to cast complete bearings in a single piece, round, smooth, straight and accurately to size, is quite another matter, especially when the proportion of length to diameter approaches or exceeds a 3 to 1 ratio. Such bearings, or bushings, are usually poured upon a mandrel having more or less taper, and require boring or reaming to bring them to finish size.

Having occasion to cast a large number of babbitt bushings, all of one size, and desiring to avoid the expense of the otherwise necessary finishing operation or operations, I made the collapsible mandrel here shown and described, by the aid of which I was able to get out the bushings rapidly and at small cost.

The mandrel consists primarily of a thick-walled tube *A*, preferably of nickel steel, somewhat longer than the bushings to be cast and enough larger in diameter than the required internal diameter of the bushings to allow the completed tool to be ground to size after assembly. The tube is cut open along one side, the width of the slot being made proportionate to the length and diameter of the tube and tapered about as shown in the accompanying drawing. In the inside of the tube, directly opposite to the tapered slot in the wall, a shallow groove is cut, parallel in width and lessening in depth toward the narrow end of the slot in the



Mandrel for making babbitt bushings to exact size of bore

opposite wall. Into the slot and groove the T-shaped taper wedge *B* is fitted.

An extension of the larger end of the wedge provides an eye for a catch-block, or shackle, by which the assembled tool may be handled conveniently. A stop-block *C* is screwed and doweled to this extension in position to contact with the end of the tube when the wedge is driven all the way in. From 0.003 to 0.005 in. expansion of the tube is sufficient to secure good results in the use of the mandrel.

A hole is drilled transversely through the wall of the tube at a right angle to the slot, passing through the web of the wedge. The hole in the web is slotted to about 1 in. in length to permit an end movement of the wedge in relation to the tube after the stop-bolt *D* is in place.

Center holes are drilled in each end of the wedge, the wedge driven into the tube as far as the stop *C* will allow, a temporary clamp put on as at *E* and the assembled tool placed in a lathe, where the ends are turned down like an ordinary lathe mandrel. Rings

IDEAS FROM PRACTICAL MEN

or clamps are then placed on the turned down ends, the temporary clamp *E* removed and the body of the mandrel ground accurately to size.

The mandrel is to be used in connection with a split mold of the desired size and shape, and the manner of its use is obvious. When the babbitt cast has chilled sufficiently to permit the withdrawal of the mandrel the latter is pulled out by tension applied in any suitable manner to the link, or shackle; or, if the mold is not too large and heavy to be handled in such manner the wedge may be pushed out in an arbor press by applying the ram to the small end.

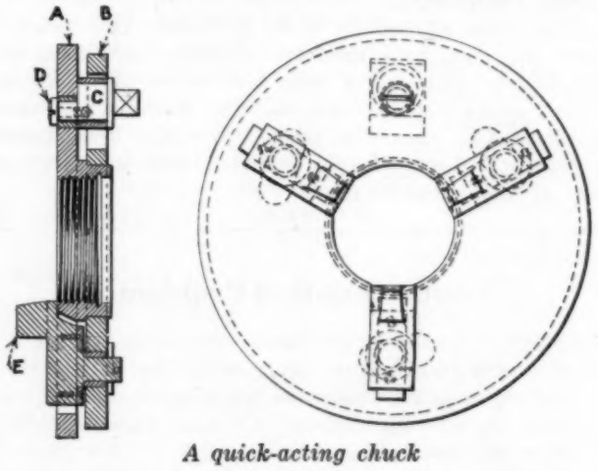
The wedge starts first and comes out as far as the length of the slot enclosing the stop-bolt *D* will allow, by which time the tube has collapsed sufficiently to permit it to be withdrawn without difficulty.

We had trouble in casting a certain kind of bushings in A-1 hard babbitt. All bushings were cast to finished size inside and outside and developed cracks that went clear through the metal, when cast on a solid mandrel. The reason is obvious. The metal contracted quicker than the mandrel and the bushing had to crack. Since we have been using the collapsible mandrel this trouble has been eliminated. The mandrel is removed immediately and quickly. In fact the instant the wedge is pulled out but a trifling distance, the mandrel collapses sufficiently to prevent the bushing from cracking.

A Quick-Acting Universal Chuck

By R. A. Maxwell

The accompanying sketch shows a universal chuck that we have used with success in our factory for a considerable length of time. The simplicity of its construction and the ease and speed with which it can be manipulated are its outstanding features.



A quick-acting chuck

The body of the chuck, *A*, is threaded to screw on the spindle nose of the machine in which it is to be used, in the usual manner. The plate *B* is so mounted upon the hub of plate *A* that it may be oscillated back and forth by means of an eccentric stud, *C*, the smaller shoulder of which turns in a bushed hole in plate *A* and is held thereto by the screw *D*, while the larger, or eccentric, shoulder carries a bushing that is flatted off on opposite sides to slide in a radial slot in the oscillating plate. The projecting end of the stud is squared to take a wrench.

Suitable jaws, *E*, are made to slide in radial channels in the plate *A*, receiving their movement from the plate *B* through the medium of studs, fitted with rollers, one of which projects from the back of each jaw and enters a corresponding angularly disposed slot in the oscillating plate. The distance that the jaws will move will depend upon the length and angle of the slots in the plate *B*, and upon the degree of eccentricity of the stud.

Drilling Holes in Cork

By H. F. Fiedler

We recently had occasion to make a number of rolls out of cork. They were to be 1¼ in. in diameter by 15-in. long, and were made by drilling a ⅛-in. hole through a sufficient number of pieces of cork of suitable size, pressing them on to a ⅜-in. cold-rolled steel shaft and turning the roll thus formed to size with the shaft running on centers.

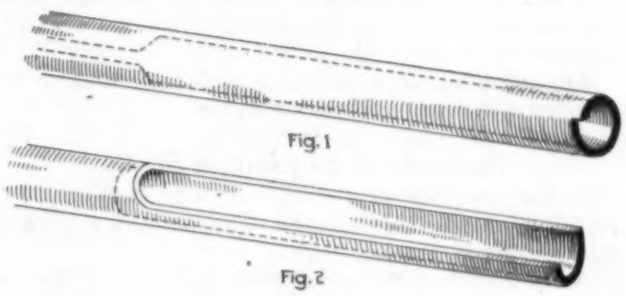


Fig. 1—The drill that did not work. Fig. 2—The successful drill

The pieces of cork in the rough were about 1⅝ in. in diameter by 1½-in. thick. I first conceived the idea of making a core-drill as shown in Fig. 1, grinding the outside to ⅛-in. in diameter and making the axial hole as large as possible consistent with strength. A smaller hole was continued through the shank, the idea being that the cork cores would have to be pushed out of the drill by means of a piece of drill-rod or wire of similar nature.

This drill did not work very well. Though it would drill the hole after a fashion, it was difficult to persuade the core to enter the hole in the drill, and the wall of the drilled hole was left very rough. I then decided to make the drill as shown in Fig. 2, and this was quite successful.

One-half the shell was cut away as shown in the sketch and the end of the drill given a slight lead. With the cutting lip ground as sharp as was possible to make it, this drill did the work in a very satisfactory manner.

The turning was a simple matter. After a sufficient number of sections were pressed on to a shaft to make up the required length, the shaft was placed on centers in a lathe and turned to size by means of a tool ground to a knife edge.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Material for Pet Cocks

Q. We have to make some special pet cocks to be used in gasoline systems and would like to have you give us the following information:

Which is the best material to use, yellow or red brass? Is it necessary to season the castings? What grinding compound would you recommend for grinding the cocks to make them tight?

A. We believe yellow brass would be all right as a material from which to make the pet cocks referred to, providing there is not enough zinc in the mixture to make it too soft. Of course, if you want to make a superior article, regardless of cost, red brass would be the best.

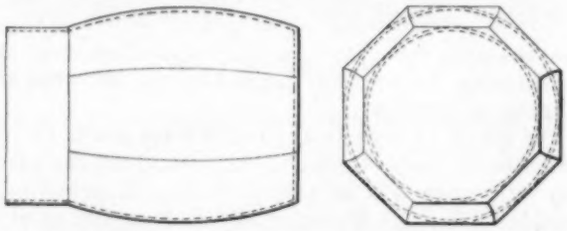
It will not be necessary to season the castings, since any change in molecular construction in such small castings would be negligible.

Any grinding paste such as used for grinding motor valves would do. Use the finest grade.

Methods of Expanding Shells

Q. Can you tell us the best way to make the cup shown by the enclosed sketch? The material is german silver, 0.004 in. thick.

A. In making the cup referred to, it should first be drawn into a cylindrical shell and then brought to its final form in a sectional die, using a rubber force to



expand it. The force should be a good grade of rubber and should be as large as can be put in the shell. The punch should fit the neck of the shell. The action of the punch on the rubber will force out the metal until it fills the die.

Another method by which the forming can be done, is to fill the shell with water while in the die and use a punch that is a tight fit in the neck of the shell. On the down stroke of the press, the water will force the shell to fill the die.

Finishing Crankshaft Bearings

Q. We have heard that some makers of automobile engines finish their crankshaft bearings by forcing a steel ball through them. Can you give us any information regarding the process?

A. We believe that you have been misinformed as to the use of steel balls for finishing crankshaft bearings.

Steel balls are used for finishing the holes in valve-guide and other bushings, but crankshaft bearings are generally line reamed with Martell or similar reamers.

Flattening Punched Work

Q. We have difficulty in obtaining flat punchings measuring 3½x2x0.020 in. The material is half-hard brass. The punchings are blanked from long flat strips, but they come out wavy and curled.

Can you tell us how to flatten these blanks?

A. Flattening punchings of half-hard brass is not an easy job.

From the description of the blanks we are inclined to believe they were made by tools having considerable shear. If the press tools were made without shear, the blanks would be more nearly flat.

You might try flattening the blanks between flat dies in a quick-running press, though a helve hammer would be better suited to the purpose. If too much pressure is used or too hard a blow struck, the blank may be distorted.

Standards for Screw Threads

Q. We have an order for dies to cut ⅝-in. bolts having National threads. Since we have never heard of the National thread, can you give us any information regarding it?

A. We do not know any thread designated as National. Possibly your customer has reference to the threads adopted as standard by the National Screw-Thread Commission.

While this thread is U.S. in form, two pitches, coarse and fine, have been specified for each diameter. The coarse pitch for a ⅝-in. bolt is the same as the U.S.S., or 11 per in., and the fine pitch is the same as the S.A.E. standard, or 18 per in. You should, therefore, find out whether your customer wants to cut bolts of fine or coarse pitch.

Connecting-Rod Problem

Several subscribers have written in to say that the information given with the problem published in the *American Machinist*, page 328, Vol. 62, was incomplete. To meet their criticism we add the following details:

Metal to be removed from small end of connecting-rod which is 9 ft. center to center.

Weight of finished rod—1,400 pounds.

The slabbing operation is to be considered as completed before the operations indicated in the problem are performed.

If those who have already submitted answers wish to make any changes because of the effect the additional information may have on their solutions, they may do so.

Remember, the closing date is April 23, 1925.

Technical Abstracts

Being a Successful Foreman

Louis Ruthenburg, general manager of the Yellow Sleeve Valve Engine Works, points out the change that has come over foremen in the last few years. Formerly he was merely the best workman in the group—the master technician—but now he must be the business manager of his department. He has to have knowledge of many things not necessarily learned at the bench or at the machine and appreciation of these facts is leading to better and broader training. The foreman himself is acquiring a broader vision of his job.

In addition to his technical knowledge he must have a knowledge of the dollar and cents part of the problem, the investment and the return, and the answer to the question, "Will it pay?" He must also have a distinct knowledge of the psychological factors that enter into his work and the enlisting of the enthusiastic cooperation of his men.

Every successful foreman at some time awakens to the realization of the fact that whereas in the old days before he became a foreman he dealt with the simple materials of his trade, his further advancement depends to a very great degree upon his control of human nature in the men under his supervision.—*The Foremen's Magazine*, January, p. 9.

Profit-Making Factory Equipment

B. A. Franklin, vice-president of the Strathmore Paper Co., discusses the question of when machine tools should be scrapped. The possession of machinery, he states, produces an insidious effect. The executive mind likes to see it produce, to earn on its investment, and hates to see it discarded as long as it is able to do what it was originally designed to do, and feels that to replace it before replacement was anticipated, or before it has outlived its usefulness, is to waste its investment. As a result, especially in the older industrial centers, there are many manufacturing units operating casually with ancient outfits unable to meet the competition of newer districts or newer units.

The author also discusses the maintenance of machinery and asks the industrial executive in the interest of economy and preservation of his investment to give this point definite consideration and develop a system of trained care and supervision, the cost of which will be well covered in the resulting eventual economy.—*Management and Administration*, February, p. 149.

Industry's Interest In Industrial Training

Magnus W. Alexander, president of the National Industrial Conference Board, discusses the decrease in apprenticeship training. He states that there is now and has been for some time a decided shortage of provision for practical industrial training of those industry requires as skilled artisans.

The necessary annual recruitment in the ranks of skilled artisans in the manufacturing and mechanical industries, seems to be about five per cent of all those employed, but this would not provide for any material expansion of industry except insofar as this may be brought about by a greater utilization of machines and power. On the basis that apprenticeship courses vary in length from three to four years' in order to obtain the necessary five per cent, 15 to 20 per cent of the total number of skilled workmen employed should be enrolled in such training courses. Altogether there are some 5,260,000 skilled artisans but, assuming that many of these possess only low grades of skill, a conservative figure of 4,500,000 might be more accurate. This would mean that there would have to be between 675,000 and 900,000 apprentices indentured in training courses, if these alone were to fill the requirements of industry for skilled artisans and for foremen and supervisors. Actually there would seem to be only some 144,000 according to the United States census in 1920.—*Mechanical Engineering*, February, p. 94.

Modern Ball Bearing Manufacture

The illustrated article by J. F. Springer, deals principally with the method of making the balls for bearings. It is a commercial impossibility to make balls that are perfectly round. Approved practice shows that balls shall be true to size, however, if measured to within 0.00005 in. This is so minute a measurement that a ball that is right at 70 deg. will be wrong at a body temperature, that is recorded at 98.4 deg. or thereabouts.

There are two chief methods for the manufacture. In the first blanks are cold severed and cold pressed from annealed cold-drawn steel wire by a continuous method; second, blanks are hot forged from hot rolled bars. After leaving one of these processes the ball is a trifle oversize and this means allowance for a slight reduction in ensuing processes. The roughly formed balls are then subject to an annealing that removes strains and stresses in the steel and then they are given their first grinding.

One manufacturer does this in a rather novel manner. The grinding wheel is rotated in a horizontal plane with a peripheral speed of about one mile a minute. The balls are held to the rapidly moving side surface of the wheel in such a way as to permit their rotation. They shift over the wheel surface and are not allowed to remain in one position. The "chaser" ring carrying them has a rotation of its own, turning at the rate of 60 r.p.m. in the direction opposite to that of the grinding surface. This causes a constant change of the axis of ball rotation which results in the balls being ground over all their surfaces. They are then hardened and are ground again on a similar apparatus. After this comes another grinding operation that is carried out on a special machine similar to a lapping machine. This is described in the article which states that this finishing polish or lapping operation brings the diameter correct to within 0.000025-in. — *Industry Illustrated*, January, p. 24.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

As It Was Eighty Years Ago

"THERE is perhaps nothing that has been the origin of so many theories and conjectures as the question What is the cause of our national distress? . . . We are perhaps the more inclined to judge thus leniently of the many theories because we too have our particular notions respecting this same national distress and probably also our favorite crotchet for its removal. We conceive that the great family of ills that have been for so long preying upon the national prosperity, wasting the resources and paralyzing the energies of the people, are all the offspring of the one primary and hitherto almost unsuspected evil, over-legislation. We can discover no radical remedy for our social maladies but a stringent regulation which shall confine our governors to the performance of their primitive duty—the protection of person and property. By way of clearing the ground I would start by routing out what are not the causes of distress. And first we propose to combat the popular notion that machinery is the main cause of our national evils."

HERBERT SPENCER—1843

For the Good of the Industry—and the Individual

IT IS not an easy task to sort out the places where we should play a lone hand from those where we should work in close co-operation with others. We have been taught individualism to such an extent that we frequently fail to see that there is another side to the case.

In every line of work, however, the welfare of the individual is so closely tied up with that of the industry of which he is a part, that the lone hand seldom gets the best result for himself. In no way is this more noticeable than in the matter of prices.

Suppose for example—and it happens all too frequently—that a builder of machines is tempted to cut his prices to secure an order that he may need very badly. It may seem wise to do this in order to keep his shop running, but if he intends to stay in business he should consider its effect on his future sales.

As soon as one builder cuts his price, buyers become slow in placing orders, both to help force prices down and to prevent buying at a higher price than their competitor. Every cut in price affects the entire market and slows up the buying of all machinery of its kind. The builder who secures an order in this way should realize that he is not only hurting all the rest of the industry but is also making it much more difficult to secure future orders at a price that will show a fair profit.

Assembling Parts by Automatic Machinery

A NEW field for special machinery seems to be opening up in the attention that is being paid to the automatic assembling of small parts. Putting nuts on bolts at an astonishingly rapid rate is a comparatively easy accomplishment. And the saving is almost unbelievable.

Some of the more intricate mechanisms contain several hoppers into which different parts are dumped as required. These parts are sorted automatically so as to be right end up when they get into the assembly fixture. In some cases such parts as springs are made by the assembling machine itself and chuted into the assembly line at the right time. The completing of the piece and ejecting the assembly into a box is done at a surprising rate. In addition to this some of the machines are so designed and built that should defective parts get into the hoppers, they are automatically rejected into a separate box.

It is also interesting to note that designers and builders of these machines are waking up to the difficulty of setting a price that will cover the real worth of their experience as well as the cost of designing and building the machine. With this in mind they are seriously considering the advisability of requiring a portion of the savings effected over a period of years, in addition to a nominal price for the machine itself. It seems to be the only way in which they can really profit by their experience.

Just Suppose

JUST suppose you have come back from a trip around the world and are telling your friends of the sights you saw. How, for instance, steamers are coaled in China by coolies carrying the coal in baskets. And suppose you explain that this is the cheapest way because wages are so low that nobody can afford to put in machinery where human labor can do the work.

And then, suppose, you go into your own factory and you see some fellows pushing heavy trucks and other fellows dragging out heavy bars of steel or turning over large castings, and your friend asks you if the wages in your place are as low as those of the Chinese coolies; what will you answer?

What would I answer? He would know better.
Of course he would, but
Just suppose.

Shop Equipment News

Fox Four-Way Multiple-Spindle Drilling Machine

The special-purpose drilling machine illustrated has been designed and manufactured by the Fox Machine Co., Jackson, Mich., for rapid production drilling on gasoline engine cylinder blocks. Set up as shown in Fig. 1, it drills 54 holes simultaneously in four sides of a six-cylinder block.

The work is located and secured in the jig illustrated in place on the work table in Fig. 3. Heads approach horizontally, from the two sides, and from within the column of the machine, and vertically from the top. Facing the front of the machine there are 23 spindles in the left-hand head, 10 in the right-hand one, 7 in the head located in the column, and 14 operated vertically.

The two main horizontal heads are individually chain-driven by motors mounted on each head. This arrangement makes it possible to choose the motor economically for the different number of spindles so that, while 10 hp. is provided for the left-hand head with its 23—1⅛-in. spindles, this is cut to 5 hp. for the right-hand head with but 10—1⅛-in. spindles to drive. The 14—1⅜-in. spindles in the vertical head are belt-driven and the 7 same-size spindles in the auxiliary, horizontal, column head are chain-connected to a 15-hp. motor set on the base as illustrated in Fig. 2, at the side of the column. The speed of the right-hand, left-hand and auxiliary spindles is set at 800 r.p.m. while the vertical ones run at 540 revolutions per minute.

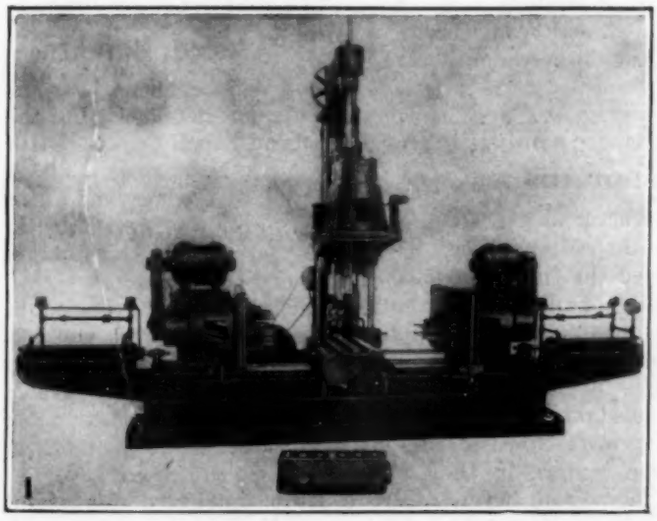
The 15-hp. motor is also belt-connected to drive a pressure pump for actuating the feed movements of the heads and a lubricating pump for the pressure-lubricating system. Oil is used as a pressure medium for the feed and is pumped to a maximum pressure of approximately 100 lb. per sq.in. for use in the two hydraulic cylinders mounted back of the main horizontal heads. The flow of oil is controlled by a hydraulic plunger-type valve secured to the base of the machine. It can be seen in Fig. 2 just under the head to the left.

The valve action is controlled by means of a lever located under the same head but on the front of the machine, to the right in Fig. 1. Depressing this lever to its lowest position opens the valve and admits pressure to the cylinders for advancing the heads to drilling position at a speed of 90-in. per min. The valve and its control are designed and set so they will be operated by the forward movement of the head to automatically cut the speed to 2-in. per min., when the drilling position is reached, and to maintain this speed forward till all the drills are to the proper predetermined depth. The valve is then further automatically actuated to reverse the movement to the original out-position at 90-in. per min. Here the heads come to rest until the operator again depresses the lever.

Feed power is applied direct to only the two main horizontal heads. The vertical and auxiliary heads receive their movement from a series of interconnecting racks and pinions arranged to equalize the feed effort and the speeds of advance, feed and return in all four directions.

In Fig. 2 the horizontal rack, with its teeth pointing downwards, can be seen attached to, and extending from the head to the left into the center section of the machine between the column and the work table. This rack also is shown in Fig. 1 where its end projects, to the left, out of the side of the center section.

Directly below this projecting portion, a very small part of another rack can be seen with its teeth pointing upwards. This rack connects to the left-hand head in Fig. 1, and also extends into the center section of the machine. Each rack is secured to its head by a clamping arrangement actuated by a small lever from the front of the head.



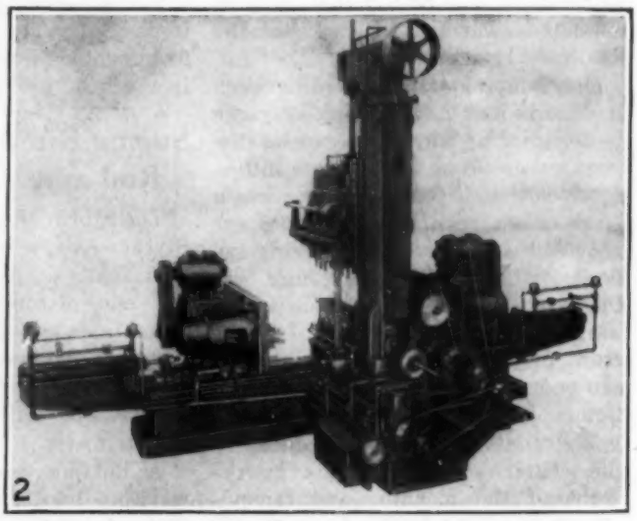


Fig. 1—Fox Four-Way Multiple Spindle Drilling Machine. Fig. 2—A rear view of the machine

SHOP EQUIPMENT NEWS

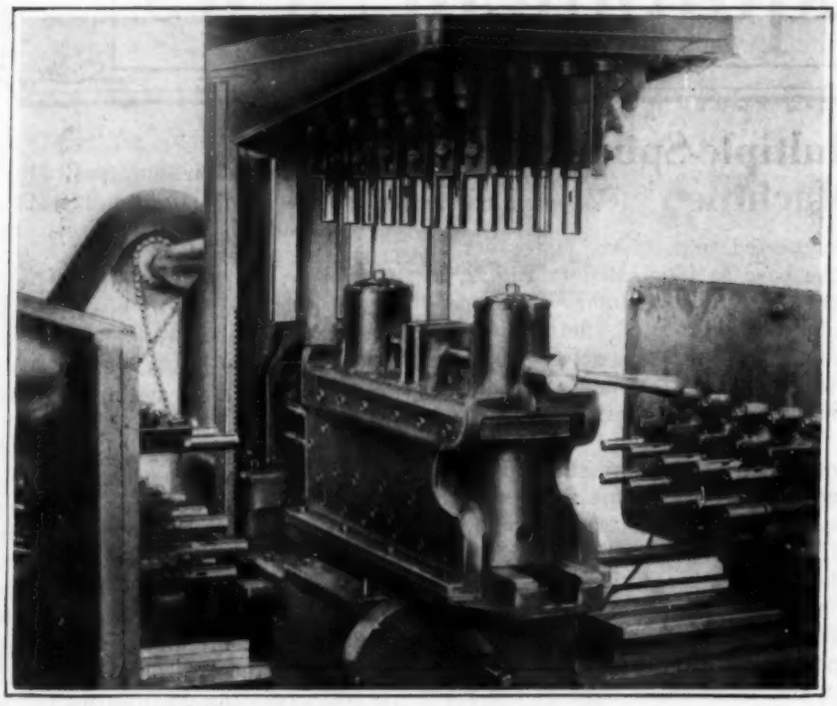


Fig. 3—The work in position in the jig

This lever for the left-hand head is shown in Fig. 1 pointing downwards.

Inside the center section of the machine, between these racks, and meshing with them, is a pinion. Another pinion on the same shaft and toward the rear meshes with a vertical rack, shown on the left-hand side of the main column, extending up to its attaching point with the vertical head. Finally, a fourth vertical rack, which is best illustrated in Fig. 2, to the left of the main column, is secured to that side of the vertical head and extends downward to mesh with a pinion that in turn extends inward to a rack on the auxiliary horizontal head.

The clamping arrangement between the heads and their respective racks is designed so any head can be disengaged or set as desired in a different position. Gears on the main heads mesh with the racks and are provided with shafts for moving the heads with a detachable crank. In the case of the two main horizontal heads these shafts extend to the front of the machine so the cranks can be used from the operator's position.

The shaft for the rack pinion in the center section extends to the front of the machine and terminates in a gear wheel. A small pinion, meshing with this gear, is provided with a squared extending shaft that will take the head adjusting crank. This arrangement enables the operator to move all the heads from the one point by hand.

Adequate lubrication of the moving parts of the machine is provided for by the Fox system of forced-feed which circulates the oil supplied through the lubricating pump previously mentioned.

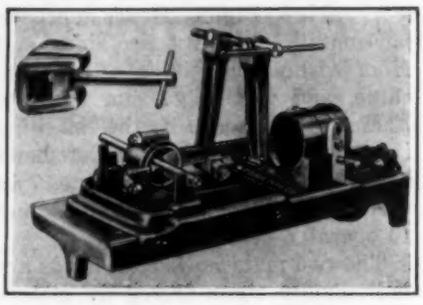
The three main heads are provided with universal spindles set in faceplates for the particular job to which the machine is assigned. They can, however, be set in other combinations if desired. The auxiliary head has fixed centers that cannot be changed in the head as it stands.

Storm Riteway Connecting Rod and Piston Aligner

The Storm Manufacturing Co., 406 Sixth Ave., South, Minneapolis, Minn., has developed the connecting rod and piston aligner illustrated. It is intended for testing and correcting alignment errors of the assembly while it is in place in the fixture, and without taking the assembly apart in any way.

A holding device centers in the wristpin bore in the piston, beyond the ends of the wristpin. It secures and lines the piston against the V-shoulders on the fixture. An indicating pin is arranged to clamp and line in the crank-end bore, without removing the cap and without regard to the size of the bore. This pin shows the condition of alignment by comparison of its position in two directions with gaging shoulders on the fixture. These shoulders are carried on a frame that can be adjusted on slides for varying lengths of rod and clamped in position.

A tool to correct for twist, in either direction, is shown in position on the rod and one for removing bends is assembled in the illustration above the fixture. Both tools are designed to make correction without throwing any strain on the set position of the assembly.



Storm Riteway Connecting Rod and Piston Aligner

The tool is particularly adapted to garage service where many different designs and sizes have to be dealt with as it will function properly without regard to dimension variation.

American "Unique" Thin-Lead Colored Pencils

A line of lead pencils of various colors has been developed by the American Lead Pencil Co., 220 Fifth Ave., New York, N. Y. as an addition to their standard product, and as an improvement over the present thick, soft leads, for drafting, checking, estimating and other uses.

The pencil is being furnished in four colors, blue, red, green and yellow and is said to have strength in the small-diameter lead comparable to that in the ordinary pencil. For ready identification the outside is colored the same as its lead.

In order to introduce this useful development the company will furnish samples on request.

SHOP EQUIPMENT NEWS

Krause "Four-in-One" Universal Machine Tool Model U. M.

Ernst Krause & Co., A-G., xx./2 Engerthstrase 151, Vienna, Austria, have developed the combination machine illustrated in Fig. 1. It is being marketed in the United States through F. W. Jaeger, 140 Liberty St., New York, N. Y. The machine consists of four distinct tools, a lathe, a shaper, a drill press and a milling machine combined into one.

The lathe swings 13¾ in. over the bed and 20¾ in. over the gap. This gap is ordinarily closed but can be made available by removing the closing pieces. The lathe bed is furnished in two lengths to take 40 in. or 60 in. between centers. There are six spindle speeds.

The arrangement of the four units permits of working simultaneously on the lathe and any one of the other three, for while the former is complete in itself, the drill press, shaper, and milling machine make use of one work table in common.

The milling machine has a 27½ x 7⅞-in. table with a 15¾-in. longitudinal, a 7⅛-in. cross, and a 19⅜-in. vertical travel. There is a choice of 5 power feeds. The arbor is ⅞ in. in diameter and has 6 available speeds.

The shaper has a provision for changing the table feed from continuous, for the milling machine, to intermittent as its action requires. There are 5 choices of feed speed. The ram has a maximum 7⅛-in. stroke and the same maximum dimension holds for the vertical distance from ram to table. It can be driven at 6 speeds.

The drilling machine has a maximum 1-in. capacity, will drill to the center of 20½ in., and has a 4-in. spindle travel. Three speed changes are available.

Power is supplied to a drive gear or belt wheel, as specified, in which a friction clutch is mounted. This clutch is keyed to the driving shaft that, as illustrated in Fig. 2, is secured to the base of the machine. The three-step cone pulley to the left is secured to this shaft and constitutes the means of driving the lathe, milling machine and shaper. The three-step pulley to the right floats on the shaft and is belted to the drill press spindle. A foot-operated jaw clutch keyed on the right-hand end of the shaft supplies power to this cone to thus separately drive the drill.

The lever *A*, Fig. 1, controls the main friction clutch. Lever *B* operates a jaw clutch that connects the lathe spindle to the source of power. Lever *C* changes the direction of rotation of the lead screw or stops it entirely. The wheel *D* and the lever *E* are two carriage controls that operate respectively from the spline and the threads on the lead screw. They are interlocked so they can only be engaged one at a time.

Due to the fact that the spindle rotation and the carriage feed are independent of each other the spindle may be held stationary by throwing out the clutch *B* while, by means of the carriage control *D* and the reversing lever *C*, the carriage may be used to operate a slotting tool on work between the centers.

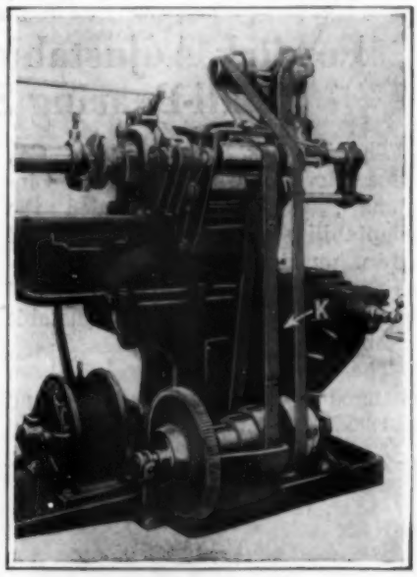


Fig. 2—The drive arrangement

Lever *F* throws a sliding gear in or out to start or stop the milling machine spindle. This spindle is in line with and somewhat below the lathe spindle. A taper is provided for the arbor and a nut, threading on the end, secures the arbor.

The vertical shaft *G* is connected to the main source of power at its upper end and constitutes the drive for the shaper ram and for the milling machine table feed. This shaft terminates in a gear box from which a shaft extends horizontally and carries a sliding gear *H* for the table feed. Another shaft runs into the bed of the machine to the shaper clutch. The sliding gear *H* is moved to the right to engage the feed gears for continuous feed. This gear is disengaged and the pawl and ratchet *J* are used for intermittent motion,

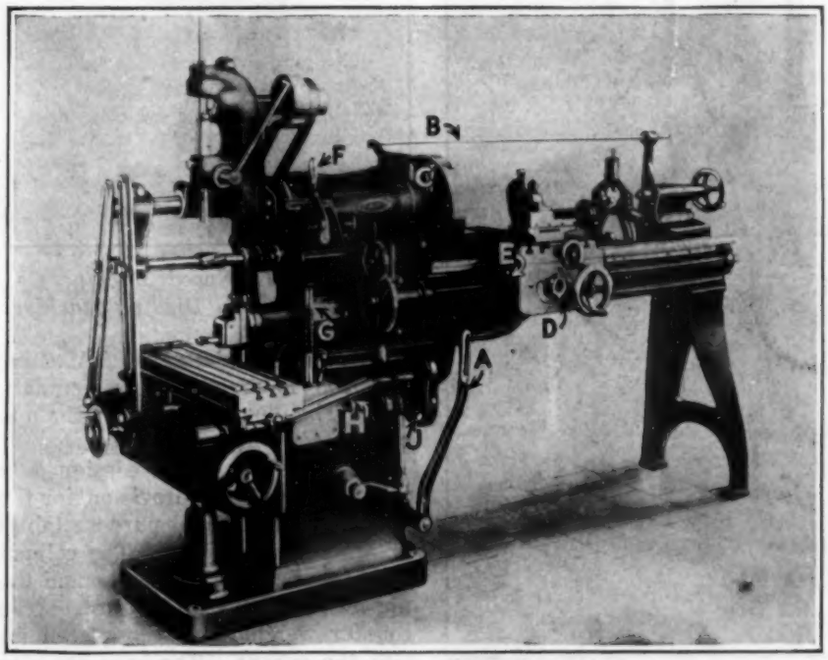


Fig. 1—Krause "Four-in-One" Universal Machine Tool, Model U. M.

SHOP EQUIPMENT NEWS

the power for which is derived from the shaper motion.

The shaper control lever is located on the rear of the machine in position indicated by *K* in Fig. 2. This lever is so arranged that it cannot be operated to start the shaper to cause possible damage should the table be raised high enough to interfere with its stroke.

The machine includes in its standard equipment 19 feed-change gears, a steady rest and a travelling rest, an independent 4-jaw chuck, a catch plate, two centers, a milling arbor complete with washers, and the necessary wrenches. It occupies a floor space, with the long lathe bed, of approximately 12 x 3 ft. and weighs 3190 pounds.

It is particularly adaptable to portable repair stations, small machine shops, garages and jobbing shops. 3 hp. is required for the drive.

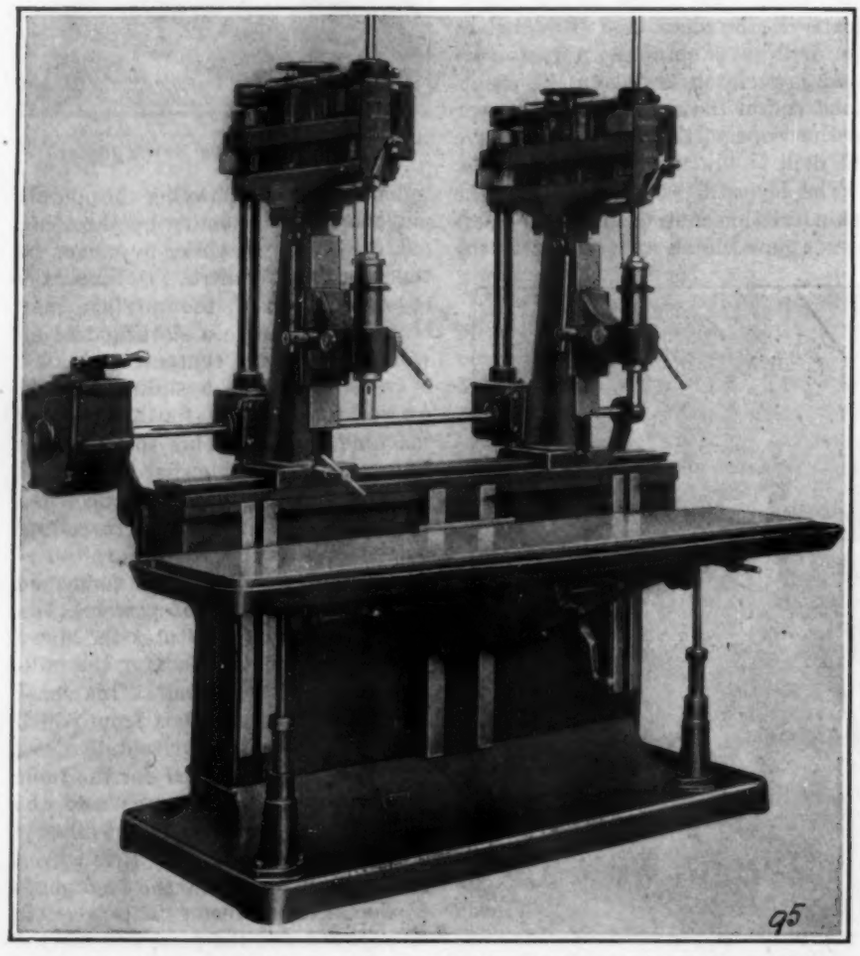
Fosdick Adjustable-Head High-Speed Ball-Bearing Sensitive Drill

The Fosdick Machine Tool Co., Blue Rock and Apple Sts., Cincinnati, Ohio, has extended the adaptability of its lines of 16-in. and 18-in. multiple-spindle drilling machines by adapting the standard bases and heads to the adjustable combination illustrated.

The top of the base has been changed to add a dove-tail way and a rack. The bottom of two head columns are fitted to this way and are provided with pinions to mesh with the rack. Shafts from these pinions are squared on the ends and project from the front of the head columns to fit an adjusting handle for moving them. They can then be set and clamped at any desired distance from each other between a maximum, depending on the size base specified, and a minimum of 12-in., when they will be together.

The spindles are driven by a splined shaft adequately supported and assembled at one end to the standard drive pulley assembly.

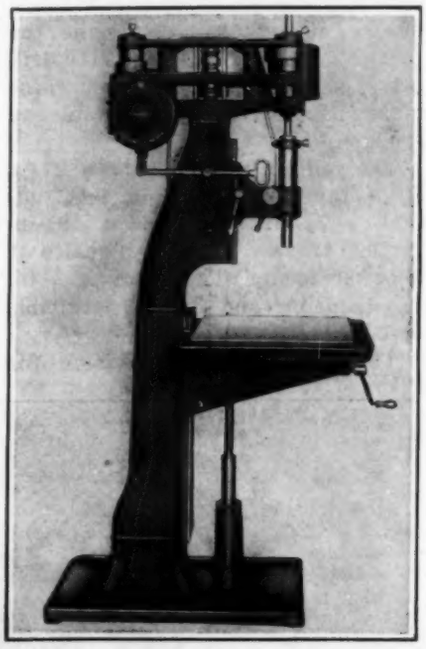
The entire line of standard bases above that for two spindles has been arranged to take the heads, so the company is prepared to furnish maximum head adjustments of 24, 36, 48, 60, 72 and 84 in. depending on which one of the 3, 4, 5, 6, 7, or 8-in. spindle bases is specified.



Fosdick Adjustable-Head High-Speed Ball-Bearing Sensitive Drill

Cincinnati Hy-Speed Machine Co. 12-In. Overhang Drilling Machine

Several changes in the design of its drilling machine as originally described on page 926, Vol. 54 of the *American Machinist* have been made



Cincinnati Hy-Speed Machine Co., 12-In. Overhang Drilling Machine

by the Cincinnati Hy-Speed Machine Co., 208 Lawrence St., Cincinnati, Ohio. The illustration shows the machine as it is now being marketed.

The table has been redesigned in two pieces to make provision for the application of special purpose tables at an economical cost. The column has been made in two pieces and the upper part moved forward. The counter weight has been placed inside the column. The base has also been altered somewhat.

News of the Week

Large Attendance at Machine Tool Exhibit in Chicago

Marshall & Huschart Machinery Co. stages successful show

An attendance of approximately 3,000 stamped as a success the machine-tool exhibit held by the Marshall & Huschart Machinery Co. in its showrooms at 17 So. Jefferson St., Chicago, March 2 to 7, inclusive. This estimate, based on a registration not exact, but considered to be representative, was felt by Marshall & Huschart officials to be conservative. The exhibit was operated all day every day and until 10 o'clock on four nights.

Twenty machine-tool builders were represented by thirty-nine machines, all in operation, most of them machining parts that constitute production work on which the machines of customers are now engaged in the field. The machines were operated by men from the factories, many of which were represented by their sales engineers, in addition to the Marshall & Huschart force.

The officers and salesmen of the Marshall & Huschart company and the representatives of the machine tool builders, without exception, were gratified at the attendance and at the quantity and kinds of inquiries. Only men interested in machine tools, most of them users, attended the exhibit. Announcement had been confined to invitations to the heads of machine shops, to news notices in the business press representing the machinery industries, and to the advertisements of some of the machine tool builders. It is expected that the inquiries will result in many orders.

Cross-Section of Machinery Industry

No particular one of the machinery-using industries was emphasized by the attendance. The registration showed a cross-section of the machinery industries, a feature pleasing in that it was indicative of improvement in general and not in a limited number of fields. "From steel mills to watch factories" sent their equipment men, as the registration was explained by H. W. Jones, president of the Marshall & Huschart company. The railroad shops and automotive plants had their share of men present and the number of out-of-town and out-of-state men was noticeable.

Two Chicago shops, both of good size, shut down for a half-day to permit their men to visit the exhibit.

At a dinner at the Machinery Club given by the Marshall & Huschart Machinery Co., on the evening of the concluding day of the exhibit, the representatives of the manufacturers extended a written appreciation to the company commending the exhibit and the spirit behind it. About fifty representatives of machine tool builders and of the selling companies were present.

The list following contains the names of the machine tool builders whose machines were in operation and tells which of their machines were shown:

The Abrasive Machine Tool Co., East Providence, R. I., horizontal surface grinder, vertical surface grinder; the Acme Machine Co., Cincinnati, Ohio, Cincinnati Acme universal flat turret lathe; Baker Bros., Toledo, Ohio, heavy pattern high speed drill, cam feed drilling machine; the Blanchard Machine Co., Cambridge, Mass., automatic surface grinder; the Cincinnati Bickford Tool Co., Oakley, Ohio, plain radial drilling machine with constant speed, direct drive upright drilling machine, high speed drilling machine; the Cincinnati Milling Machine Co., Oakley, Ohio, plain high-power milling machine, universal milling machine, centerless grinder, self-contained saddle-type plain grinder, universal tool and cutter grinder; The Cincinnati Planer Co., Oakley, Ohio, Hypro planer; the Cochrane Bly Co., Rochester, N. Y., metal sawing machine, automatic saw sharpener, duplex universal vertical miller and shaper; the Giddings & Lewis Machine Tool Co., Fond du Las, Wis., internal grinding machine, horizontal boring, drilling and milling machine, portable radial drill; Gould & Eberhardt, Newark, N. J., shaper, gear hobber; the Keller Mechanical Engineering Corporation, Brooklyn, N. Y., automatic die cutting machine, cutter grinder, flexible shaft grinder; the Landis Machine Co., Waynesboro, Pa., single-head bolt-threading machine; the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, Duomatic, tool room lathe; the Moline Tool Co., Moline, Ill., cam-feed driller; the National Automatic Tool Co., Richmond, Ind., multi-driller, automatic multi-driller; the Oilgear Co., Milwaukee, hydraulic broaching machine; the Oliver Instrument Co., Adrian, Mich., drill pointer, drill point thinner; the Sebastian Lathe Co., Cincinnati, Ohio, engine lathes; the Sipp Machine Co., Paterson, N. J., two-spindle quick-change speed drill press; the V. & O. Press Co., Hudson, N. Y., open back inclinable press.

Ford Will Have Plant at Chester, Pa.

The Ford Motor Co. is completing negotiations for the taking over of the Merchants Shipbuilding Co. yard at Chester, Pa., where it will erect a large branch plant. It has not been definitely decided whether the new plant will be an assembly or manufacturing branch. The plant, however, will become the chief distributing center for Ford automobiles in the East, making Chester the company's main seaport for shipping direct to Europe and South America. The Philadelphia assembly plant will probably be eventually moved to Chester in its entirety.

Date Is Set for the New Haven Exhibit

The Fifth Annual New Haven Machine Tool Exhibition will be held in Mason Laboratory of Yale University from Sept. 8 to 11, 1925. The exhibit will again be under the auspices of the New Haven Section of the American Society of Mechanical Engineers, Yale University, and the New Haven Chamber of Commerce.

A special effort will be made to have the exhibit this year international in scope and of an even higher standard than in former years. An attempt will be made to eliminate everything that is not strictly in the machine-tool line. The technical program will be of high caliber and of undoubted value and interest to all manufacturers or users of machine tools.

The committee in charge of the exhibition this year consists of H. R. Westcott, chairman; Ernest Hartford, assistant chairman; S. W. Dudley, W. W. Gaylord, J. D. Marsh, K. F. Lees, E. Oberg, Wm. Buxbaum, E. W. O'Brien, C. Oppe, A. F. Breitenstein, G. Holmes, G. P. Simpson and G. Welter.

Dr. Geier Representing U. S. at Conference

The health section of the League of Nations invited the Surgeon General of the United States to nominate a physician to represent this country in a conference to be held in Geneva. This conference will start in Geneva and will then be continued in Belgium, France, Holland and England, and Dr. Otto P. Geier, director of the employees' service department of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been chosen as the representative.

The commission will consist of ten physicians, one from the United States, and the other nine from European countries, to study the industrial hygiene problems of these respective countries.

The physicians in those countries are called Medical Inspectors of Labor, for which we have no counterpart in this country. The actual study is to be made between March 23 and May 4.

France Must Deal with Many Problems

The British debt and consequences—The battle of the franc—Preparing for foreign trade—Domestic business improves—Auto industry slowing down—American agricultural machinery in favor.

By Our Paris Correspondent

JUST as France was girding her loins for the coming commercial campaign at home and abroad a new complexion was given the situation by the summary appeal for discussion of the French war debt owed to Great Britain. Monsieur Herriot, chief of the government and Monsieur Clementel, the Minister of Finance are to meet Mr. Baldwin, the British Premier and Mr. Churchill in London in March for a possible solution of the problem.

Britain's "out-of-works" are clamoring for more free commercial exchanges with France which the present low value of the franc as compared with sterling does not permit. France, on the other hand, wants the sum total of her war debt reduced. If this is assented to by England "for business reasons" (as indeed the British debt to America was "funded" on the same materialistic basis) it will mean a possible influx in the French metallurgical market by British manufacturers in competition with the French industry.

The "battle of the franc," as the annual report of the Bank of France puts it, is the one problem that discounts all others as itself is discounted by the exceedingly involved political situation in France and abroad.

The same authority states that the basic metallurgic trade is the keynote of the situation and that its "progression" being most satisfactory nothing should be done that would retard it. Pig iron production increased during the past year by two and a quarter million metric tons and steel by two million tons. Foreign trade balances increased nearly a billion and a half francs in favor of France. Imports increased seven and a half billion francs and exports increased eleven billions.

Fear Germany's Plan

At the recent banquet of the French Machinery and Foundrymens' Association the statement was made that France had proof positive that Germany was about to launch an export dumping campaign and that this might be taken to mean a direct attack on French industry. It was stated, also, that the metal transforming industries of France now gave employment to 800,000 workers, the annual turnover of business done being twenty-two billion francs. It is here that the great struggle will take place.

In early February trade in machine tools was reported more satisfactory than for some months. Lathes for export were in demand by shipping factors and commission houses. Presses for sheet metal working, cutting tools and small machine equipment were also in demand. Woodworking machinery was less called for than during the previous quarter. Export orders were increasing among large manufacturers.

Evidence is found that France is preparing to go after foreign business as never before in the recent founding of a Foreign Trade Library in Paris, where are on file 1,600 current papers and magazines from throughout the world and 400 annuals, or year books, giving trade statistics and other information classed by industries. This is a government controlled and subsidized institution. The director has stated that he regrets the lack of a sufficient "documentation" on Germany. The avowal is significant and argues that it is from that quarter that the keenest competition is looked for in world markets on metals in all fabricated forms. Couple this with the possible outcome of the Franco-British debt conference and commercial accord —whatever form they may take— France, decidedly, has its work cut out both for the immediate and remote future.

Market Conditions

Small tools, with some exceptions, found a continued satisfactory demand. Files and saws are increasingly demanded, but hammers and forge tools have slowed down at prices that are virtually stationary. Machine tools, as is obvious when the slowing down of the important automobile industry is taken into consideration, are finding less call than was current last year at this time. Prices in most lines are firm, little effort apparently being made to influence business on that score for the very reason that labor costs, overhead and taxes are increasingly heavy from season to season.

The automobile industry has reduced production to a low figure. Manufacturers who depended largely upon the sale of the miniature 5, 6, and 7 hp. cars that are becoming so numerous in France and that have formed a large element of automobile exports, are manifestly at the limit of distribution possibilities of the moment, though it is considered premature to speak as yet of a crisis in the industry.

Rolling stock for railways has received little impetus of late save a few small export orders. The Paris-Metropolitan underground railway has ordered a series of new cars for its increasing services since the first of the year. A hitch in the proceedings is still holding up the order for 4,000 freight cars that the Paris, Lyons and Mediterranean Railway was to place in Germany on its own behalf and that of the other French trunk railways. French manufacturers have protested to the government against this order going out of the country, recalling the situation which was brought about when the International Sleeping Car Co. placed an order for new de luxe train equipment with the running gear and chassis made in America and the bodies made in England. This possible order going to Germany is considered by those interested as one of the first disastrous effects of the Dawes plan. The argument is not quite clear save that it hits the French manufacturer while on the other hand it benefits the country at large in that a certain draw back will be paid into reparations account later.

As to agricultural machinery, imports from the United States may benefit from a reduced custom tariff if the voice of Monsieur Chausey in the Chamber of Deputies last week is listened to. American agricultural machinery and tools have greatly changed French farming methods since 1912 in an increasingly satisfactory geometrical progression. According to this authority "American manufacturers have considerately made purchase terms as reasonable as possible." This is a gratifying observation out of the many and varied criticism of American financial and business methods which are being met with in France today. Business friendship is quite as important a factor in international amity as political friendship.

In spite of the continual influx of foreign contract labor in various industries, and the avowed need thereof, there is arising a considerable opposition on the part of nationalists. Doubtless the question is grave as certain communes in the north and east of France have as high as 60 per cent of foreigners in their population.

Auto Production Gains in February

The National Automobile Chamber of Commerce estimates the output of cars and trucks in February at 277,600, a gain of 15 per cent over January. Final production figures in January were 231,071 cars and trucks and in February, 1924, total was 362,473.

The report says: "Active spring markets were indicated both in the factory shipment reports and the statement of business conditions by dealers.

"The industry regards the situation as favorable since there is less tendency to stock in anticipation of spring demand this year and accordingly output figures reflect actual sales.

"Reports from dealers of most sections of the country bear this out stating that new car stocks are light, that used vehicle inventories are cleaning up and that demand in the truck field continues active. Winter sales have been better than last year in the Middle West, although lighter on both coasts."

Personals

DR. OTTO P. GEIER, director of the Employees' Service Department of the Cincinnati Milling Machine Co., sails March 14 for Cherbourg, France. He was chosen by the Surgeon General of the U. S. Army to represent this country in a conference that will be held in Geneva, to study the industrial hygeine problems of Belgium, France, Holland and England.

W. R. BASSICK, formerly of Bridgeport, Conn., has assumed the presidency of the Commerce Motor Truck Co. of Ypsilanti, Mich. W. E. Parker, former president, has been elected chairman of the board of directors. Edward Graham is vice-president, E. S. Evans, secretary-treasurer, and C. L. Granger, general manager of the factory. The Commerce Motor Truck Co. occupies the old Saxon Motors plant in Ypsilanti, originally built by the Apex Motor Co.

W. H. KLOCKE, for twenty years chief engineer of the E. W. Bliss Co., Brooklyn, N. Y., has been elected vice-president and general manager of the Keiner Metal Forging Co., Richmond Hill, N. Y.

M. B. MACNEILLE has been promoted from chief engineer of the hydraulic department to manager of the pump division of the Fairbanks, Morse & Co. at Three Rivers, Mich.

ARTHUR W. WIESE has been appointed manager of the Philadelphia office of the Strom Ball Bearing Co., Chicago. His headquarters will be at 309 Lincoln Building.

FREDERICK P. NEHRBAS has been appointed assistant general manager of the Stutz Motor Car Co. of America, Inc., Indianapolis, Ind., and will have charge of all production.

W. R. HANS has been made district manager of the Buffalo district for the Whiting Corporation, Harvey, Ill. His headquarters will be at 997 Ellicott Square.

JOHN F. STEVENS will be presented the John Fritz Gold Medal in the auditorium of the Engineering Societies Building, 29 W. 39th St., on the evening of March 23.

JAMES H. MACLAFFERTY, ex-congressman from California, and HAROLD N. GRAVES of the Bureau of Efficiency, have been appointed assistants to Secretary of Commerce, Herbert Hoover.

J. P. FLIPPEN has been appointed the representative of the Farrel Foundry & Machine Co., Buffalo, N. Y., in the Pittsburgh district. His headquarters will be at 649 Union Trust Co. Building.

W. E. PIERCE will be chief body engineer and designer of the Nordyke & Marmon Co., Indianapolis, Ind. He is the president of the Hume Body Corporation, Boston.

BRADFORD H. WHITING has severed his connection with the Whiting Corporation, Harvey, Ill., and its subsidiary, the Grindle Fuel Equipment Co., owing to illness. He was vice-president and general manager of the Whiting Corporation and president of the Grindle company.

ERNEST W. TAYLOR was recently elected to the board of directors of the L. S. Starrett Co., Athol, Mass. Mr. Taylor will fill the vacancy caused by the death of James A. Stiles.

W. F. ARMSTRONG, formerly of the Remy Electric Co., has been named production manager of the Olds Motor Works, succeeding HUGH C. DUNNING, former vice-president, resigned.

WITOLD M. AULICH has left his position with the Rodney Hunt Machine Co. of Orange, Mass., to become chief of the engineering department and supervisor of the cost department of Arma, Ltd., in Lwów, Poland.

J. L. SAVAGE has been named superintendent of service of the Gray Motor Corporation of Detroit.

R. A. RAWSON, formerly of the merchandising department of the Franklin Automobile Co., Syracuse, N. Y., has been appointed head of the merchandising department of the Stutz Motor Car Co. of America, Inc., Indianapolis, Ind.

LOUIS E. CLARKE has been appointed to take charge of the Detroit branch of the Hoyt Metal Co., Detroit. For the past five years Mr. Clarke has been sales manager of the bearings and die casting department.

FRED. J. BECHERT, secretary of the Metropolitan section of the American Society of Mechanical Engineers, has joined the law firm of Mitchell & Bechert, 350 Madison Ave., New York City. Mr. Bechert is a mechanical and chemical engineer as well as a lawyer.

ARTHUR D. LITTLE, Boston, has been elected to succeed CHARLES H. HERTY as chairman of the advisory committee of the Exposition of Chemical Industries.

STUART A. ATKINS succeeds RUSSELL M. WILLIAMS as sales and advertising manager of the William L. Gilbert Clock Co., at Winsted, Conn. Mr. Williams is going to the New Haven Clock Co., at New Haven. C. S. GATES replaces JOSEPH CLEARY as foreman of the tool repair department of the William L. Gilbert Clock Co.

ROBERT J. O. SIMPSON, superintendent of the L. S. Starrett Co., Athol, Mass., was recently presented with a gold watch by his associates. He has been with the company for the past twenty-nine years.

JOHN ANDERSON, secretary-treasurer, and a director of Vickers & Combustion Engineering, Ltd., will make his headquarters at the Montreal office of the company, Canada Cement Building, Phillips Square.

A. C. SPAHN, vice-president and general manager of the Bernardin Bottle Cap Co., Evansville, Ind., would like the address of a Mr. Ellis who was superintendent of the tool room at the Curtis Airplane Co. plant in Buffalo, during the war.

ROLAND F. EVERITT has been named production manager of the Trippensee Closed Body Corporation, Detroit in addition to his duties as secretary-treasurer.

OSCAR B. CINTAS has been elected a director and vice-president of the American Car & Foundry Export Co., New York, succeeding the late CHARLES S. GAWTHROP.

JAMES P. FARRELL, formerly president of the Farrell-Stoneham Co., and the Federal Tool Co., Dayton, Ohio, is now president of the recently organized Miami Tool & Die Co., Dayton, Ohio.

A. O. CASH has been appointed purchasing agent of the Rollin Motors Co., Cleveland, O. Mr. Cash succeeds E. A. CALLANAN who was made general sales manager of the organization simultaneous with the introduction of the new series of Rollin models.

LAMBERT M. PAYNE has retired as purchasing agent of the Northway Motor & Manufacturing Company, Detroit, to become district representative of the D. J. Ryan Foundry Co. of Ecorse, Mich., the Allyne Ryan Foundry Co., of Cleveland, Ohio, and the Dean Forging Co. of Muncie, Ind.

H. G. JACKSON has been appointed vice-president and general manager of the Wire Wheel Corporation of America, Detroit, succeeding G. M. WILLIAMS.

T. F. THORNTON has been elected president of the Roehm Steel Rolling Mills, a new Detroit concern. He recently resigned as purchasing agent of the Detroit Steel Products Co.

ROBERT G. WATSON, formerly mechanical superintendent of the Nova Scotia Steel & Coal Co., Ltd., Wabana, Newfoundland, has been appointed chief engineer of the St. John Dry Dock & Shipbuilding Co., St. John, New Brunswick.

GEORGE MEYERRATAKEN, FORREST T. CRANE and HARRY J. BUETTINGER, of the J. A. Fay & Egan Co. are among the incorporators of the Oakley Foundry Co., who will erect a plant in Oakley, Ohio. Capital is $300,000.

ROBERT P. WALLER has been appointed the representative of the Farrel Foundry & Machine Co., Buffalo, N. Y., in the Boston district. His headquarters will be at 916 Little Building.

H. J. HOYT, associated with the Morgan & Wright plant of the United States Rubber Co. in Detroit for 19 years in various capacities, from draftsman to chief engineer, has severed his connection with that firm. Mr. Hoyt is taking a vacation before announcing future plans.

J. C. HAGGART, JR., chief engineer of the Republic Motor Truck Co., Inc., Alma, Mich., has been appointed to the position of assistant to the president. Mr. Haggart's new duties will be in addition to those of chief engineer, a position which he has filled for the past three years.

W. H. MCINTYRE, of Ottawa, Canada, has been elected vice-president of the Ottawa Car Manufacturing Co.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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LAST Thursday the Bank of England raised its rate from 4 to 5 per cent. To many American business men this statement will seem meaningless and to others it will be without much significance for on its face the cost of borrowed credit in far away London does not seem a very important matter to the manufacturer in the Middle West or the merchant on the Pacific Coast.

But it is important nevertheless for it means that the unlent supply of lendable capital is smaller than it was and it also means that Great Britain does not intend to let the United States outbid her in the competition for what is left. For it is manifest that the Bank of England raised its rate by 1 per cent because an advance of half as much was announced a week ago by the Federal Reserve Bank of New York, and from the speech made by Reginald McKenna as well as from what is published in the English papers it is also manifest that the bankers of Great Britain are determined to prevent any export of capital to this country.

The world will do well to heed the notice thus given that a contraction of credit impends. But human nature is so constituted that the import of the facts will not be admitted until it is made plain by the logic of events. Men are prone to construe the news in accord with their own interests or preconceptions. This explains why so many now assert that higher interest rates are an evidence of better business and higher prices. Most of those who take this view will be directly or indirectly benefited by a further advance in stocks or commodities and their philosophy is shaped by their desires.

Therefore effect will probably be slow to follow cause and those who heed the warning of the money market will have plenty of time to act if they agree with the writer that the interest rate when the world is at peace is about the only reliable barometer of business conditions that has as yet been evolved. Sometimes, it may rise or fall long before we become conscious of the high or low pressure whose approach it foretells, but it is rarely at fault unless the law of supply and demand is suspended by governmental action.

In the present instance it is, of course, too early for the advance in interest rates to have had anything more than a sentimental effect upon a stock market boom so vigorous that it has great resistance. It has been called a "Coolidge boom" and there were many who expected that the President's admirable inaugural address would revive a market that has recently shown some signs of fatigue.

But this expectation was disappointed and as the week closes there seem to be more sellers than buyers of both stocks and bonds. This is natural for since the election the advance has been almost unbroken and the professional speculators always sell on good news. But the question is can the buying movement be started again? Only time can answer and the answer will probably be determined by the course of the money market which should be closely watched.

What's Doing in Industry

From most of the machinery and machine tool centers come reports that business is assuming a steadier tone than has been evident in several years. At times since the World War business has been noticeably better and more often noticeably worse, so that the concensus of opinion seems to be that the present steadier tone may be favorably regarded.

Automobile production was greater in February than in January and indications are that it will be as great or slightly better in March than in either of the preceding months. Machine tool men sold some tools to the motor car makers and expect to sell more during the next two or three weeks.

Railroad equipment makers are potential customers and a few orders were placed during the past week for tools. Car builders and locomotive makers are busy and have excellent prospects for the remaining months of the first half of the year. Railroads are inquiring for tools as usual and in a little better volume than was noted last week. Buying from this source also improved a trifle.

The attention of many machine tool manufacturers is still directed toward exporting and some are finding it a lucrative outlet for their products. Credits are improved in most instances, and the demand just now is active. Whether German competition will become a factor later in the year is problematical, but American makers, with some exceptions, do not seem to consider it too seriously at this time.

Used machine tools found a better market during the week, but this end of the machine tool business could stand improvement, dealers say.

Meantime it is worth observing that the Federal Reserve Banks lost $33,000,000 in gold last week and that the reserve ratio, which stands at 75.6 per cent, would have been lower if the balance due the member banks had not decreased by $43,000,000. This decrease is indicative of credit contraction and the probable destiny of the funds withdrawn is suggested by the figures which show the condition of the more important member banks.

These figures, published regularly by the Federal Reserve Board, show that from Jan. 2, 1924 to Feb. 18, 1925, the deposits of the member banks have increased by $2,347,000,000 and that of this increase $1,517,000,000 or more than 63 per cent, has been invested in or lent on securities. Attention is called to these facts because they afford a partial, but not altogether reassuring explanation of the buoyant stock market and the success of the many bond flotations.

Some say America will end the season with less than no wheat on hand, while others insist that a considerable surplus will be left. "When doctors disagree laymen despair" and when statisticians commence to quarrel speculators generally run away. Coffee is in much the same position as wheat. The experts have fallen out and speculation has deserted the market.

Iron is down 50 cents a ton and steel is also lower. The trade authorities attribute the decline to the large production, but it is also due to what is described as the "repressed buying" of the automobile industry. But the automobile manufacturers are repressed in their buying because the dealers are not selling as many cars as last year. So it goes. Copper, zinc and tin have also declined and as the spring opens up it becomes plainer that there will be less building than some had expected.

But bank clearings continue to gain on last year. The railroad traffic is large. The dry goods trade is a little better than normal and cotton fabrics in particular are in good demand. The unemployment though appreciable is not increasing and, although there is, as always, some maladjustment, nothing that is in sight need give the careful business man concern if he is attending to his affairs.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

Business during February in the Chicago territory was neither better nor worse than anticipated at the beginning of the year. Dealers state that the market is inactive, but that they are expectant of an upward trend during March, inquiries indicating that the buying of necessary equipment cannot be deferred beyond a certain point, which seems to have been almost reached.

None of the expected railroad budgets have made their appearance, which is somewhat of a disappointment.

The Production Meter Corporation is in the market for the following: 1 20-in. Smith shaper; a milling machine; 1 1-in. vertical head; 1 ⅝-in. Brown & Sharpe screw machine; a bench lathe; a Universal grinder; a magnetic chuck; a small hand grinder; a small power bench chuck; a foot power shear.

An announcement of interest to machinery men is that, on March 11, the American Society of Mechanical Engineers, Chicago section, will hold a machine tool meeting in this city. Several men prominent in machinery production lines will make addresses, among them being F. F. Gardner, the Gardner Machine Co.; J. R. Shea, the Western Electric Co.; R. R. Keith, the International Harvester Co.; S. A. Hellings, the Stewart Manufacturing Corporation, and F. E. Cardullo, the G. A. Gray Co.

Detroit

A gradual movement toward the rehabilitation and replacement of machinery now used along the motor assembly lines of Detroit's automobile plants appears to be underway.

Executives in the automotive field are none too talkative about the changes understood to be imminent, but the keen competition being felt by the leaders in the industry has created the feeling that newer machinery along the assembly lines will materially decrease the cost of the finished product and thus enable the manufacturer to better meet his competition.

Inquiries have been directed by a number of companies to representatives of machinery and machine tools in Detroit for new equipment of this nature, and the evidences bear out the belief that the next six months will see more and more business in this field.

Reports that the market for used machinery is improving, especially among the smaller manufacturing plants in Michigan, have been received during the past week. Railroads are announcing larger orders for new equipment.

The demand for electrical equipment among the automotive manufacturers has been a larger factor than usual.

February sales, although spotty as a whole, showed a slight increase over January, while the March figure will probably exceed that for either January or February.

An official of one of the Detroit concerns has just returned from an Eastern trip and reports that the heavy demand for its automatic drilling equipment presages great activity in the manufacturing field for the coming year.

New England

Connecticut furnishes the instances of the improving trend of the machinery industry in the last fortnight. Bridgeport is the particular spot that is brightest. A new industry, being the American branch plant of an English company, is hastening equipment deliveries at a factory in Bridgeport, where it is intended to quickly come into the market with its products. The work to be done here will be of the assembling character.

Sewing machine manufacturing shows decided improvement with the buying for export shipment exceeding the volume of domestic business. The buying is by continental countries, Russia excepted. Russia, which formerly bought about the same number of machines that were bought in the United States, is now entirely out of the market and furnishes little ground for hope of being a good market for some years to come.

Larger machinery builders report continued good demand for immediate deliveries, although within a week there has been a falling off in this kind of business, but an increased volume of inquiry has been observed. The tone of the inquiry is of the sort that furnishes reason for belief that the production requirements will be increased and require overtime operations, unless delivery periods can be extended.

The automobile trade continues to improve, production being of bigger volume and employment expanding to some extent.

Cincinnati

The majority of the manufacturers and sellers of machine tools report an increase of business, but not to the amount that had been expected. As one manufacturer expressed it, "The business is convalescing rapidly, but it has not yet completely recovered or regained its former vigor." The general feeling is one of mild optimism, and all anticipate that the business curve will rise. Users are losing the over-conservatism they acquired from the collapse of the boom of 1920-21, it is stated, and self-confidence and a progressive spirit are returning.

The automobile business is regarded as the most conservative trade in the buying of machine tools, and the electrical industry is said to be somewhat cautious in buying. A large demand is expected to come from railroads in the near future as they have budgeted large amounts for repairing and replacing equipment. Not many orders for machine tools are coming from textile machinery houses, but inquiries are coming in.

The orders received are scattered over a large territory, and the absence of localization of demand is regarded as indicative of a general improvement of business all over the country and not merely in spots. Foreign orders are increasing, and further demand is expected in the near future from that source.

An increased demand for repair parts is reported by several manufacturers, who take this to mean that increased business is causing shops to put back into service machines that have been idle and out of repair. This activity does not seem to be confined to any one line of equipment, but scattered over several lines.

Canada

Business conditions on the whole throughout Canada are pursuing a normal course with some gradual seasonal improvement and better orders are reported for machinery, building materials and industrial supplies generally. Work on railway orders recently released is proceeding rapidly and new business is appearing. The Ontario government has placed an order with the Canadian Locomotive Co., Kingston, Ontario, for three locomotives for the Temiskaming & Northern Ontario Railway.

At Hamilton, Ontario, the Steel Co. of Canada has again started its 20-in. mill on substantial orders for railway equipment, including an order from the Canadian Pacific Ry. for fish plates. The Algoma Steel Corporation has orders for steel rails that will keep the plant operating from four to five months. The B. Greening Wire Co. at Hamilton, is operating some of its larger departments on double shifts owing to the receipt of large orders. The opening of six additional open hearths, the rolling of a 35,000-ton rail order for the Canadian National Railways and a concurrent big increase in the operations of the Sydney steel plant were recently announced by the vice-president of the British Empire Steel Corporation.

The first intimation by the federal government regarding likely changes in the tariff this year came in the form of an announcement by the minister of

the Interior that the duty on oil-drilling machinery would be much reduced or removed entirely.

January production of pig iron in Canada rose 23 per cent to 28,302 long tons, compared with 22,544 tons in December.

The manager of export sales for one of the largest automobile manufacturing concerns in the United States recently stated that the sales of his firm in Canada for the last three months of 1924 were 126 per cent greater than for the same period in 1923, and advance orders for January to March this year were far in excess of those for 1924.

Canadian exports of automobile parts continue to show steady increase. The shipments for the twelve months ended January, 1925, were valued at $4,931,319, an increase of $1,280,359 compared with the previous twelve months. Automobile parts are now being exported to twenty-three different countries, the principal customers being South Africa, Australia, Argentina, New Zealand, the United Kingdom and Brazil.

New York

Improvement in buying by general industrials, some closing on railroad lists, and purchases of power and drill presses by the electrical companies were the contributing factors to a fairly satisfactory week in the New York machinery and machine tool market. The Lackawanna bought on part of the list issued recently, the New York Central was in the market for several single tool purchases, and the General Electric Co. bought presses.

Inquiries have been made by the Baldwin Locomotive Works for a small list of tools and it is rumored that there is a good sized list in the offing from this same source. Other locomotive and freight car builders are expected to be in the market also within the next two weeks.

General industrials showed more activity during the week than for some little time past. Industrial building seems to be improving and expansions are noted in many parts of the East. The Ford Motor Car Co. has purchased a site in Chester, Pa., a new industry using machine tools is opening in Bridgeport, and dealers in the Metropolitan section have many leads for sales in other directions.

Last week proved to be another good week for exporters with sales recorded in South America and Italy. It is understood that one of the large Japanese houses in New York City is about to close on a list of machine tools, but with whom and when cannot be learned.

Buffalo

Business is fair in Buffalo. Some firms report no more activity, while there are a few that report some orders although there are none of any great consequence. However, an optimistic tone prevails. Inquiries are good and everyone seems to feel that there will be a fair amount of business for all during the next few months.

It is interesting to note that there is an increase in the demand for road machinery over last year. There was some thought that when the demand for snow removal equipment subsided with the loss of the heavy snow, that this line of business would languish for a time, but it developed that road construction contractors are making plans for a busy season and are making their preparations well in advance.

There is a report that the American Radiator Co. of Buffalo has a large list out for the equipment of a new manufacturing plant to be erected in France. There is considerable interest in the list, although it is doubtful if any of the local offices will get a chance at it.

Business Items

The Whiting Corporation, Harvey, Ill., has recently appointed the following agents: S. C. Elbe, Inc., 211 Tramway Building, Denver, Colo.; Edward S. King, 306 Elmhurst Building, Kansas City, Mo.; and the Snyder Foundry Supply Co., Drawer 251, Huntington Park Branch, Los Angeles, Calif.

The Hill Clutch Machine & Foundry Co., Cleveland, has recently appointed T. L. Rose & Son, Pittsburgh, Pa., as its representative in the Pittsburgh district. The headquarters are at 901 House Building.

The Moline Foundry Co., Moline, Ill., has changed its name to the Moline Foundry & Machine Co.

The Miles Machinery Co., Saginaw, Mich., has purchased the entire machinery equipment of the Transport Truck Co., Mount Pleasant, Mich.

The nail and wire departments of the Northern Bolt & Wire Co., Ltd., Owen Sound, Canada, were recently destroyed by fire with a loss estimated at about $75,000.

The Superior Forging Co. Detroit, has changed its name to the Street Forging Co.

The Super Steel Products Co., Milwaukee, is a new corporation organized by Walter A. Belau, formerly office manager and estimator, and Charles J. Wamser, formerly factory superintendent of the Biersach & Niedermayer Co., Milwaukee, manufacturer of fireproof sash, doors, screens, partitions, etc. A factory has been equipped at Hawley and State Sts., in Wauwatosa, suburb of Milwaukee, in a leased building, but it is intended to erect a new and larger factory during the year. The line of products is similar to that of the Biersach & Niedermayer Co.

The following have been granted certificates of incorporation by the Illinois Secretary of State at Springfield: The Vanbosch Pneumatic Motor Car Co., 433 E. Eleventh St., Chicago; to manufacture and deal in autos, machinery, appliances, etc.; the Funk Forging Co., Seventeenth St. and Fifth Ave., Chicago Heights to manufacture and deal in tools, forgings, and commodities of steel, iron, metal, etc.

Fire destroyed the Morris Park electrical repair shops of the Long Island R.R. at 123d St. and Atlantic Ave., Richmond Hill, New York, recently with a loss estimated at between $300,000 and $500,000. Twenty-five locomotives were badly damaged and six railroad coaches were ruined.

Henry Hope & Sons, England, having taken part of the American & British Co., Bridgeport, Conn., plant for the assembling of steel window casements, have delivered forty carloads of machinery at Bridgeport. Operations will begin shortly.

The foundry of the British Empire Steel Corporation, at Sydney, N. S., was destroyed by fire Feb. 25. Two electric cranes, some machinery and some large castings were ruined, but the pattern shop with its valuable contents was saved.

The Davis Pipe & Fittings Co., of Birmingham, Ala., has acquired the plant of the Iron City Pipe & Foundry Co., 4000 N. Thirty-fourth St., North Birmingham. It is reported the former company plans enlarging and installing additional equipment in the Iron City plant.

Purchase of the plant and equipment of the T. J. Price Foundry & Machine Co., Denmark, S. C., by the Denmark Machine & Foundry Co., also of that place, was announced this month by T. E. King, general manager of the latter company. Additional equipment is to be installed, including lathes, drill presses, etc., in the Price plant for general machine work and the manufacture of sawmill edgers, trimmers, etc.

The Milwaukee Corrugating Co., Milwaukee, manufacturer of sheet metal products, building materials, etc., has acquired the entire interests of the Cicero-Chicago Corrugating Co., of Cicero, Ill., and will continue its operation as a branch plant. Other branch factories are maintained at Kansas City, Mo., and LaCrosse, Wis. A new distributing warehouse, with 50,000 sq.ft., has been leased in Chicago at 4650 W. Harrison St., in charge of W. F. Waller.

Obituaries

JUSTIN E. GRIESS, vice-president of the McMyler-Interstate Co., Bedford, Ohio, died recently. He was fifty-one years old.

EDWARD H. RAYMOND of Chicago, vice-president of the Crane Co., died in his berth on a Texas & Pacific train last week on a trip from Texas to New Orleans.

THOMAS PINK, aged 84 years, a Canadian tool manufacturer of long standing died at his home in Pembroke, Ontario recently. Mr. Pink was president of the Thomas Pink Co. and a director of the Victoria Foundry, Ottawa, the Superior Electrics, Ltd., and a number of other companies.

Machinery Exports in January

Exports of metal-working machinery during January, with revised comparative figures for January, 1924, as compiled by the Department of Commerce, are as follows:

	Jan., 1924 Value	Jan., 1925 Value
Lathes	$77,954	$87,753
Boring and drilling machines	54,999	64,466
Planers, shapers and slotters	12,778	79,083
Bending and power presses	9,764	57,470
Gear cutters	24,380	60,520
Milling machines	32,072	129,582
Thread cutting and screw machines	133,029	64,748
Punching and shearing machines	4,697	17,272
Power hammers	24,124	13,287
External grinding machines	93,489	125,257
Internal grinding machines	12,117	11,202
Other grinding and sharpening machinery	18,191	38,237
Chucks for machine tools	24,279	21,485
Reamers, cutters, drills, taps, and other metal-working tools	212,952	172,728
Pneumatic portable tools	100,305	75,620
Foundry and molding equipment	23,578	51,246
Other metal-working machinery and parts of	356,418	382,169
Total	$1,215,126	$1,452,129

Look Out for This "Buyer"

Machine tool builders and dealers are warned that a man using the name of Hirsch and claiming to represent the Hillman Manufacturing Co., Los Angeles, Calif., has been ordering machinery and giving bogus checks on the Hillman company as part payment and on the strength of the order obtaining money from the manufacturer or dealer. He is wanted by the police of Cleveland, Ohio.

Budd Buys Detroit Site

The Budd Wheel Co., Philadelphia, has purchased the property of the Columbia Motor Co. with land area 23 acres and floor space 130,000 sq. ft. The sale disposes of the last principal asset of the bankrupt concern. The property was formerly owned by the defunct Liberty Motor Car Co., having been acquired by the Columbia at the receivers' sale.

Calendar of Local Meetings

American Society of Mechanical Engineers

Waterbury, March 13. Sectional Meeting. Chamber of Commerce Hall. "The Engineering Profession—Its Antiquity and Its Obligations," Dr. William F. Durand, president of the A.S.M.E. J. R. Putnam, secretary, Waterbury Clock Co., Waterbury, Conn.

Salt Lake City, March 14. "Machine Tools." W. H. Trask, Jr., secretary, University Club, Salt Lake City, Utah.

Charlotte, March 16 and 17. Joint meeting of Greenville, Raleigh and Charlotte branches. F. S. Davant, secretary, the Grinnell Co., Inc., North Charlotte, N. C.

Birmingham, March 17. Sectional Meeting. "Manufacture and Use of Malleable Iron," George L. Morehead. G. L. Bentley, secretary, the Ingersoll-Rand Co., 1802 American Trust Building, Birmingham, Ala.

Hartford, March 17. Sectional Meeting. Hartford Engineers' Club. "Industrial Mobilization," Major Hobart Somers. C. W. Mayott, secretary, the Hartford Electric Light Co., 266 Pearl St., Hartford, Conn.

Milwaukee, March 18. Sectional Meeting. Milwaukee Athletic Club. Meeting devoted to co-operation with State University on education and training of the industries. Robert Cramer, secretary, 1105 Vliet St., Milwaukee, Wis.

Toledo, March 19. Sectional Meeting. Doehler Die Casting plant. "Visit to the Plant," J. A. Schultz. H. L. Allen, secretary, the Toledo Scale Co., Toledo, Ohio.

New York, March 19. Sectional Meeting. "Development and Use of the Locomotive Stoker," E. W. Englebright and A. B. Fahnestock. T. J. Bechert, secretary, 350 Madison Ave., New York City.

National Association of Cost Accountants

Worcester, Mass., March 12. "The Use of Ratios in Cost Accounting."

Chicago, March 12. "Cost Finding for Different Types of Business."

Philadelphia, March 13. "Credit and Factors in Extending the Same—Character, Capacity, Cash and Collateral," J. H. Tregoe, secretary of the National Association of Credit Men.

Cleveland, March 18. "Financing as a Burden."

Rochester, March 18. "The Future of Motion Study in Industry," V. M. Palmer, the Eastman Kodak Co. "Methods Used in Tying up Factory Accounting with General Accounting," C. J. VanNeil, the Eastman Kodak Co.

Buffalo, March 19. "The Cost of Government," and "The Manufacturing Budget."

Trade Catalogs

Elevators. The New Jersey Foundry & Machine Co., 90 West St., New York City. Portable elevators and those used in warehouses and factories, particularly of the one- and two-ton variety, are described in this catalog. Most of the types shown are operated by a hand lever, although some more intricate are designed for heavier work. There are many illustrations and the text is clear and brief.

Chain Hoist. The Motorbloc Corporation, Philadelphia, Pa. There is a general description, oiling directions and a list of the parts of the motor-driven chain hoist made by this company in this bulletin that has been issued mainly as an instruction book for maintenance and operation of the product.

Induction Motors. The General Electric Co., Schenectady, N. Y. Bulletin No. 47640.2 devoted to induction, time, overcurrent relays and other topics has been issued. It describes the four forms of overcurrent relays, together with the applications of each. Details of construction, lists of available ratings and principles of operation are covered, together with general information. The bulletin is illustrated by photograph, charts and diagrams, and contains 15 pages.

Riveters. The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The Hanna "pinch bug" riveters are briefly described and illustrated in this little four-page folder that is perforated for filing. Three half-tone illustrations are used to show the product and a diagram is also used which is called, "Anatomy of Hanna Pinch Bug Riveter."

Cranes. The Cleveland Crane & Engineering Co., Wickliffe, Ohio. The electric tramrail made by this company is well shown in this booklet. That it will effect a saving in handling costs is pointed out as well as the safety and efficiency of using this form of overhead factory transportation.

Speed Transformer. The Poole Engineering & Machine Co., Baltimore, Md. Type H and type K speed transformers are shown in two separate folders recently mailed out and called bulletin 105 and bulletin 106. The wide range of adaptability, the low cost of maintaining, the substantial manner of construction, and other data are included in both bulletins.

Power Transmitting Machinery. The W. A. Jones Foundry & Machine Co., 4401-4451 Roosevelt Road, Chicago, Ill. General catalogue No. 30 is a 5½x7½-in., 448-page book. It contains, in addition to the specifications and price lists of the company's product, a great deal of valuable information. The data are interestingly presented in tabular form and are helpfully illustrated with photographs and diagrams. The book is arranged to offer many useful suggestions to assist the engineer and designer in making economical power-transmitting layouts. It is also designed to conserve the purchasing agent's time that is required to refer to specified items, in order to secure the required materials. In short, it is a valuable engineering data and reference book in addition to its usefulness as a company-product catalog on gears, reducers, pulleys, clutches, chain, bearings, sprockets, rope wheels and numerous other related items.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Marine motors for kerosene and crude oil. Macao, China. Purchase and agency. Reference No. 13,911.

Motor-driven small buffers. Hurstville, Australia. Agency. Reference No. 13,878.

Electrical appliances and labor-saving devices. Birmingham, England. Agency. Reference No. 13,875.

Tools and tool specialties for mechanics. London, England. Purchase. Reference No. 13,890.

Conveying and elevating machinery. Helsingfors, Finland. Agency. Reference No. 13,906.

Machinery for pressing out steel pans or trays for wheelbarrows. Johannesburg, South Africa. Purchase. Reference No. 13,909.

Mill equipment, cranes and pumps. Colombo, Ceylon. Purchase and agency Reference No. 13,935.

Mining machinery such as hoisting and conveying. Warsaw, Poland. Reference No. 13,850.

Road machinery. Helsingfors, Finland. Purchase and agency. Reference No. 13,950.

Sheet metal working machinery. Prague, Czechslovakia. Agency. Reference No. 13,910.

Forthcoming Meetings

National Metal Trades Association. Twenty-seventh annual convention. Hotel Cleveland, Cleveland, Ohio, April 22. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

The National Supply and Machinery Distributors' Association. Twentieth annual convention. Ambassador Hotel, Atlantic City, April 27, 28 and 29. George A. Fernley, secretary and treasurer, 505 Arch St., Philadelphia, Pa.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7, 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Activity in iron buying is a trifle more pronounced this week than last; price line-up unchanged. Railway materials continue to form one of the main features of current steel buying. Structurals are not especially active. Prices of the principal heavy rolled products range from $2 to $2.20 per 100 lb. at Pittsburgh mills. Improvement in demand is noted in steel pipe and wire products. Foreign competition in c.-i. pipe and steel shapes is being felt in the Middle Atlantic states. Trend is upward in prices of bolts, nuts, rivets, washers, screws, etc.

Non-Ferrous Metals—Prices of metals in this class are below quotations of a week ago. Copper, lead and zinc, however, are firm at present levels.

Linseed Oil—Raw oil down 3c. in New York and 4c. per gal. in Cleveland during week.

(All prices as of March 6)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$26.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.25
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70@2.80	3.89	3.45	3.80
No. 12	2.80@2.90	3.94	3.50	3.85
No. 14	2.90@3.00	3.99	3.55	3.95
No. 16	3.10@3.20	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.35@3.55	4.55	4.15	4.30
Nos. 22 and 24	3.40@3.60	4.60	4.20	4.35
Nos. 25 and 26	3.45@3.65	4.65	4.25	4.40
No. 28	3.50@3.70	4.75	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75@3.85	4.75	....	4.50
Nos. 12 and 14	3.85@3.95	4.85	....	4.60
Nos. 16	4.00@4.10	5.00	....	....
Nos. 17 and 21	4.15@4.25	5.15	....	4.90
Nos. 22 and 24	4.30@4.40	5.30	3.00	5.05
No. 26	4.45@4.55	5.45	4.15	5.20
No. 28	4.75@4.85	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 1/32, 8.35c.; ⅛, 7.85c.; 3/32 to ¼, 7.35c. per lb. Chicago, 1/32, 8.85c.; 3/32, 7¾c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			55.25
Lead (up to carlots), St. Louis	8.65	New York	9.25
Zinc (up to carlots), St. Louis	7.47½	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	21.00	....
Copper sheets, base	23.00	22.75	22.12½
Copper wire, base	20.62½	21.37½	20.75
Copper bars, base	22.25	23.25	22.62½
Copper tubing, base	25.25	25.37½	25.75
Brass sheets, base	19.62½	19.75	19.25
Brass tubing, base	24.25	25.50	25.00
Brass rods, base	17.62½	18.87½	18.37½
Brass wire, base	20.12½	20.75	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.50	11.75	11.37
Solder (½ and ½), (case lots)	42.00	37.50	.....
Babbitt metal (83% tin)	60.00	65.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.00	12.00
Copper, heavy, and wire	12.25@12.50	12.00	11.50@11.75
Copper, light, and bottoms	10.75@11.00	10.00	10.50
Heavy lead	7.50@7.75	7.50	8.00
Tea lead	6.50@6.75	5.00	6.75
Brass, heavy, yellow	7.75@8.00	7.75	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.75@7.00	6.75	6.75
No. 1 yellow rod turnings	8.00@8.25	7.00	8.00
Zinc	4.50@4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12¾
Wiping cloths, 13½x13½, per lb	9.50	36.00 per M	.11
Wiping cloths, 13½x20½, per lb.	.....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.21	1.28	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.33	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1762½	.1762½	.155
Solder (½ and ½)	per lb.	.42	.42	.39
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.60	.58
Machine oil	per gal.	.33	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.75@5.00
White lead, dry or in oil	100 lb. kegs	New York, 16.25	
Red lead, dry	100 lb. kegs	New York, 16.25	
Red lead, in oil	100 lb. kegs	New York, 17.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ⅜-in., ⅞-in., 1 in. diam. x2 7/16-in. to 4 13/16-in., per 100 lb	$5.00*	$3.50	$3.50
Cone heads, ditto	5.20*	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	7.00*	4.00	3.75
⅝-in., per 100 lb.	6.00*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x 5/16-in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for 5/16-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, 7/16x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Los Angeles—D & B Pump and Supply Co., 301 West Avenue, 26. (oil well pumps and oil supplies)—equipment and machinery for new shop.

Ind., Muncie—Muncie Malleable Foundry Co., Highland Ave.—machinery for foundry making automobile castings.

Mass., Brighton (Boston P. O.)—F. C. Hersee Co., 22 Parkman St.—equipment for manufacture of automobile tools for proposed factory in Watertown.

Mass., East Boston (Boston P. O.)—J. H. McCulpha, 567 Bennington St.—tools and equipment for repair garage on Harmony St.

Mass., Lynn—V. Maribito, 70 Tudor St.—miscellaneous tools, and equipment for repair garage at 843 Washington St.

Mass., Roxbury (Boston P. O.)—Kudish & Kager, 521 Seaver St.,—miscellaneous tools for garage at 1246 Massachusetts Ave., Boston.

Mass., West Newton (Boston P. O.)—C. M. H., P. O. Box 64—No. 0 and No. 00 Brown and Sharpe automatic screw machines.

Mich., Detroit—Dodge Bros., Inc., Jos. Campau Ave.—equipment for light hammer shop.

Mich., Sault Ste. Marie—Wynn Auto Sales Co.—repair shop lathe, drill press, and air compressor.

N. Y., Brooklyn—J. Brandmaier, 1670 George St.—lathe 16 x 8, 30 in. cutter for cardboard, 16 in. sensitive drill press.

N. Y., Buffalo—Lawler Iron Works, 18 Gull St.—foundry equipment for plant addition.

N. Y., Buffalo—M. E. Tire Service Co., 1066 Michigan Ave.—small tools and equipment for service station.

R. I., Providence—W. S. Achorn, c/o R. I. Motor Co., 265 Plain St.—equipment for proposed $1,000,000 garage on Union St., between Fountain and Sabino Sts.

Wis., Milwaukee — Harnischfeger Corp., 871 Robinson Ave. (excavation machinery) —core making equipment, including ovens.

Wis., Milwaukee—J. M. Hollitz, 445 Jefferson Ave.—sheet metal working machinery.

Wis., Milwaukee—Northern Conveyor & Mfg. Co., 3204 Auer Ave.—machine tools, equipment and cranes, for new plant in Janesville.

Wis., Milwaukee—Standard Sheet Metal Works, 1485 30th St.—sheet metal working machinery for new plant.

Ont., Wiarton—Wiarton Marine Railway, c/o W. Nimmo—equipment for repair plant, to replace fire loss.

Que., Montreal—Berry Feldspar Co., Ltd., c/o H. C. Bellew, Suite 7, 43 St. Francis Xavier St.—equipment and tools for blacksmith shop.

Que., Montreal—R. Bois, 410 Laurier St. —complete equipment for garage and auto repair shop, at 14-16 Clarke St.

Opportunities for Future Business

Ark., Clarendon — White River Lumber Co. will build a saw mill, 40,000 ft. daily capacity, by day labor.

Calif., Los Angeles—Albertson Motor Car Co., 1540 South Figueroa St., will soon receive bids for the construction of a 2 story, 100 x 300 ft. factory, at 50th St. and Long Beach Ave. Estimated cost $175,000. J. M. Cooper, Marsh-Strong Bldg., Archt. Noted Feb. 26.

Calif., Los Angeles—D & B Pump and Supply Co., 301 West Avenue 26, awarded contract for the construction of a 50 x 150 ft. factory. Estimated cost $40,000.

Calif., Oakland—F. L. De Sonno, 1853 38th Ave., awarded contract for the construction of a 2 story machine shop, on East 12th St. near East 29th Ave. $19,265.

Calif., San Bernardino—State Highway Comm., Forum Bldg., Sacramento, awarded contract for the construction of maintenance shop, and truck shed, here. $24,853.

Calif., San Francisco — City Sash and Door Co., R. Crothers, Monadnock Bldg., awarded contract for the construction of a sash and door mill at Mission and 14th Sts. Estimated cost $40,000. Noted Feb. 19.

Ind., Muncie—Muncie Malleable Foundry Co., Highland Ave., plans the construction of new plant, to replace fire loss. Estimated cost $150,000.

Ind., Rushville—Lee Anders, will build a 60 x 100 ft. furniture factory, by day labor. Estimate cost $45,000. Private plans.

Ill., Sterling — National Manufacturing Co., awarded contract for the design and construction of a 5 story factory, to the Austin Co., 160 North La Salle St., Chicago.

Mass., Allston (Boston P. O.)—Seavey Realty, c/o J. S. McLean, 160 Allston St., awarded contract for the construction of a 2 story, 120 x 180 ft. garage at 1-15 Scottfield St. Estimated cost $150,000. Noted February 19.

Mass., Boston—Chamberlain Garage, Inc., 110 Tremont St., awarded contract for the construction of a 5 story, 18,000 sq.ft. garage at 16 Stoneholm St. Estimated cost $150,000. Noted Feb. 12.

Mass., Boston—J. M. Howe, 10 State St., will receive bids about March 15th, for the construction of a 6 story, 27,000 sq.ft. garage at Cambridge and Freen Sts. Estimated cost $1,500,000. R. H. Doane, 162 Newbury St., Archt. Noted Feb. 12.

Mass., Boston — Kudish & Kager, 521 Seaver St., Roxbury, are receiving bids for the construction of a 125 x 300 ft. garage, at 1246 Massachusetts Ave., here. Estimated cost $200,000. A. Rosentein, 220 Devonshire St. Archt. Noted Feb. 26.

Mass., Cambridge—General Radio Co., 11 Windsor St., awarded contract for the construction of a 4 story, 50 x 100 ft. factory, at Windsor and Cambridge Sts. Estimated cost $40,000. Noted Feb. 12.

Mass., New Bedford—F. J. Greene, c/o L. L. LaBrode, 502 Olympia Bldg., Archt., awarded contract for the construction of a 2 story garage on Elm St. Estimated cost $200,000. Noted Jan. 22.

Mass., Worcester—J. P. Coughlin, c/o Coughlin Electric Co., plans the construction of a 4 story, repair and service garage, at Commercial and Exchange Sts. Estimated cost $400,000. Private plans.

Mich., Detroit—Dodge Bros., Inc., Jos. Campau Ave., is having plans prepared for the construction of a 75 x 500 ft. light hammer shop, on Jos Campau Ave., Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts.

Mich., Detroit—Paige Detroit Motor Co., Fort St. and McKinstry Ave., plans the construction of a 2 story office and garage building, on Warren Ave. Estimated cost $150,000. A. Kahn, 1000 Marquette Bldg., Archt.

Mo., Kansas City—Columbian Steel Tank Co., 1505 West 12th St., will build a 3 story, 92 x 130 ft. steel tank factory as first unit of plant, by day labor.

Mo., Kansas City—National Lead Battery Co., 1601 Oakland Ave., has tentative plans for enlarging plant to double present capacity.

N. J., Trenton—J. E. Thropp & Sons, Inc., Lewis St., plans the construction of a 82x162 ft. machine shop on Fair St. W. E. S. Dyer, Land Title Bldg., Phila., Pa., Archt.

N. Y., Yonkers—Otis Elevator Co., 260 11th Ave., New York City, is having plans prepared for the construction of a 4 story, 100 x 350 ft. addition to plant on Atherton St., here. W. Moyer, Ch. Engr.

O., Cleveland—Bryant Heater & Mfg. Co., 952 East 72d St., O. Fox, V. Pres., will receive bids until March 10th for the construction of a 150 x 300 ft. factory, at East 179th St. Estimated cost $125,000. G. Fox and A. F. Foose, Auditorium-Garage Bldg., Archts. Noted Jan. 22.

O., Cleveland — Motors Realty Co., c/o Ohio Buick Co., 1903 East 19th St., G. G. Peckham, Pres. is receiving bids for the construction of a 10 story, 135 x 320 ft. garage and repair shop on Euclid Ave. and East 24th St. Estimated cost $1,000,000. W. S. Ferguson, 1900 Euclid Bldg., Archt.

O., Cleveland—V. Perry, c/o J. F. Bontempo, 308 Euclid Avenue Bldg., Archt., is having plans prepared for the construction of a 1 and 2 story garage and factory building on Woodland St. Estimated cost $150,000.

O., Cleveland—Vance Motor Co., W. L. Vance, Pres., East 9th St. and Central Ave., is having plans prepared for the construction of a 2 and 4 story garage and salesroom. Estimated cost $150,000. A. F. Foose, 212 Auditorium Garage Bldg., Archt.

Pa., Coraopolis — Standard Steel Spring Co., 843 Fourth Ave., awarded contract for the construction of a 60 x 90 ft. addition to spring factory, on Fourth Ave. Estimated cost $40,000.

Pa., Johnstown—Mitchell Spring & Mfg. Co., Inc., Horner St., L. H. Mitchell, Pres., plans the construction of a 2 story, 30 x 160 ft. factory and office building. Estimated cost $100,000.

Pa., Lewisburg—Ruhl & Watson, Mifflinburg, and W. Rhoadesof, Lewisburg, plan the construction of a 2 story, 50 x 120 ft. sash and door factory here. Estimated cost $100,000.

R. I., Providence—Promenade Realty Co., 524 Westminster St., awarded contract for the construction of a 2 story, 130 x 160 ft. garage on Westminster St. Estimated cost $200,000.

Tex., San Antonio — Ward Heater Co., 1243 South Hope St., Los Angeles, plans the construction of a factory, including foundry, plating, assembling plants, warehouse, and administrative offices. Estimated cost, $250,000. Private plans.

Wis., Milwaukee—Harnischfeger Corporation, 871 Robinson Ave., manufacturers of excavation machinery, is taking bids for the construction of a 62 x 90 ft. core room, on Robinson Ave. Private plans. Estimated cost $25,000.

Wis., Milwaukee—Milwaukee Grey Iron Foundry Co., 39th Ave. & Mitchell St., awarded contract for the construction of a 42 x 100 ft. addition to foundry. Estimated cost $25,000.

Wis., Milwaukee—Standard Sheet Metal Works, 1485 30th St., c/o E. G. Schroeder Co., 405 Broadway, Archts., will receive bids until March 21 for the construction of a 1 and 2 story factory, on 30th St. Estimated cost $50,000.

Wis., Milwaukee — Strobel & Bloedow, 1436 Green Bay Ave., plans the construction of a 42 x 120 ft. sheet metal shop, on Port St. Estimated cost $25,000. Private plans.

Wis., Wausau—Curtis & Yale Co., Clinton St. & South First Ave., will build by day labor a 2 story 75 x 150 ft. factory for manufacture of interior finish sash and doors.

Wis., West Allis—Allis-Chalmers Mfg. Co., Greenfield Ave., plans the construction of a transformer shop.